



# THE FOUNTAIN

TRINITY COLLEGE CAMBRIDGE

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Newton and Clerk Maxwell

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Bombay barrister

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Choir on Disc and  
Down Under

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Cool messages from chips

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Time and cosmology  
in verse

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Alumni Advisory Board

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Admissions: myth  
and reality

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Trinity Calling

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Fellows News

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The Trinity Carol Roll

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# EDITORIAL

We, the young especially, live in uncertain educational times. We hoped that this *Fountain* would carry a comprehensive statement of the University's understanding of the new funding arrangements for higher education, 'access' conditions, financial support in cases of need, and so on. John Rallison (1970), Fellow and the University's Pro-Vice-Chancellor for Education, is well placed to give us such a statement and looks forward to doing so, perhaps in the next issue of this Newsletter. At present government policy is still under discussion, particularly on the question of 'access'. But the University's current position on financial assistance (where needed), of greatest interest to applicants for admission and their families, can be found at [www.cam.ac.uk/admissions/undergraduate/finance/2012entry](http://www.cam.ac.uk/admissions/undergraduate/finance/2012entry).

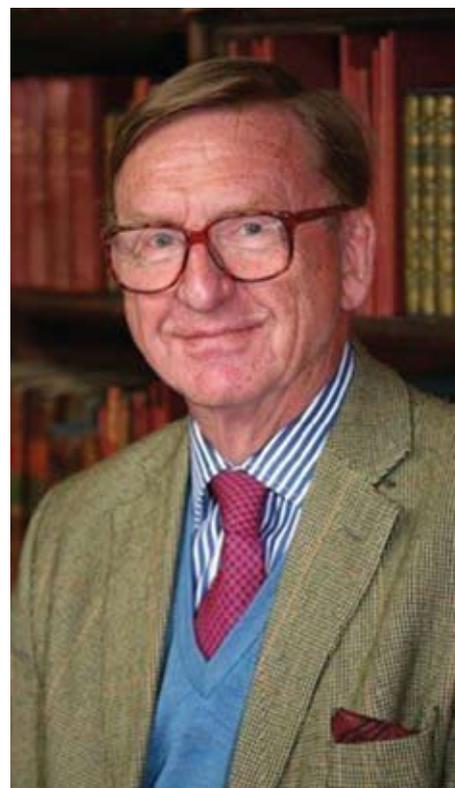
This issue of *The Fountain*, however, shows Trinity's determination to remain at the top of the tree of knowledge. William Morris (1981) explains the Alumni Advisory Board's readiness to help in this. Tony Bannard-Smith, our Head of Alumni Relations and Development, reports on our telephone campaign, which surprised both callers and recipients with its friendliness and fruitfulness. Tragically, Ian Daghish (1970), whose enthusiasm we quote, died as we were going to press. We are grateful to Joy for allowing us to quote him.

How are College Fellows using its resources? Mbou Eyole-Monono (2007) and Peter Littlewood (1997) give us glimpses of Trinity's scientific and computing excellence, past and

present, with pointers to the future. Mbou says he could not have done his particular doctoral research otherwise than at Trinity. The Fellows' News pages tell of other achievements across a range of disciplines: family law, dam-busting, Byzantine history, cosmological poetry, legal biography, the anthropology of imperialism and the theology of daily life—and Sophie Hannah, a Fellow Commoner in the Creative Arts in 1997–99, enlivens our back page with a timely poem.

But we should be proudest of our junior members, the seedbed of Trinity's future. They came top of Cambridge's Tripos League this year, yet again. They sing in Oxbridge's best College Choir—judged by an international panel of judges earlier this year to be the fifth best choir in the world! Joanna Harries (Choir volunteer 2009–11) and Paul Nicholson tell us of their triumphs in Australia and on disc. On the field, the next *Annual Record* will carry the story of sporting successes, too. Paul Wingfield (1990), our Admissions Tutor, explains why it is not donnish tricks but scholarly talent that brings these young men and women here, despite press myths to the contrary. Yug Chaudhry (1998) gives a moving account of the sort of challenges some of them may later face in their professional lives.

Recent issues of *The Fountain* have carried examples of 'Trinity Trivia', a quiz based on research into Trinity's history by Michael Farrow (1954). Sadly Michael, a good friend to his College, died earlier this year. Robert Eddison (1955) has carried this



recently-invented bottom-of-the-page tradition further by sending in some 'Original Aphorisms', the first of which can be enjoyed in this issue. Any other amusements of similar quality, devised by members, will be gladly considered.

*Professor John Lonsdale (1958), Fellow,  
Editor-in-Chief*

## EDITORIAL BOARD

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# WHAT IS THE AAB?

By Will Morris



Trinity was good to me. Travel funds, book prizes, an extra year at Cambridge, a year at a US law school. The funds from earlier endowments just kept flowing. I waited to be asked to give something back... and waited. Trinity didn't really keep in touch either, other than the decennial (or so) Annual Gathering and the (slightly stiff) *Annual Record*. So when, eventually, five years ago, John Lonsdale invited me to join the new Alumni Advisory Board, it sounded like the perfect opportunity to give back. But what is the AAB?

The College Council started the AAB, made up of 12 alumni/ae, to advise the internal Alumni Relations Committee. In five years the College has come a long way: from one to five alumni relations staff; from one College Association (Lawyers) to six; from almost no annual donation income to £2m a year (for a five-year total £12m); from almost no major gifts to the imminent appointment of a Campaign Director for major (seven-figure) gifts. So what remains for the AAB to do? Is it time for a group that most of you have never heard of to fold its tent? Well, perhaps not yet.

First, on alumni relations, the College has increasingly reached out but, compared to our US peers (and, yes, that is the right point for comparison) we still have a way to go. Our data is incomparably better than five years ago, but we are only starting to use it. Year Groups, a staple of US alumni life, need to be established. We need to get more alumni/ae back to College. The College Associations are great ways for people in various sectors to socialise, but they could also be used to funnel ideas back to the College. In all of these, the AAB can act as the contact point and liaison between the College and its alums.

And Fundraising: the most obvious, and most difficult, question asked by alumni/ae is: 'Why should I give to Trinity, when the College is already so affluent?' The AAB would be happy to tell you! Some, like me, were beneficiaries of earlier generosity. Others have done very well financially and feel the need to give back so others can benefit – especially now with higher tuition fees. Most importantly, we all feel the most compelling reason is that Trinity is not an island. Cambridge is a world-class university, but, comparatively, not all that wealthy. Over the past 23 years, Trinity has supported not only its own Fellows and students, but the entire university through the Newton Trust. With changes in government support and rising overseas competition, the challenge can only grow. So yes, thanks to inspired bursarial activity over the past 40 years, Trinity is wealthy. But there's no point in being the best college in a second-rank university. The

AAB feels passionately about this, and would love to tell you more about it.

So the AAB still has a role. We can act as a focal point to channel your ideas and views back to the College, and ensure that Trinity reaches out to you. We can help with the tricky issue of fundraising, making the College's case. But we can do neither unless we hear from you. The AAB has been fairly unknown until now, but we'd like to become more accessible. Send any of us an e-mail (see below) if you have an idea. Tell us if you'd like us to talk to you or an alumni group. Tell us what you like – or don't like – about alumni/College relations and fundraising. Please don't be shy. Trinity has a remarkable past. It's up to all of us to ensure it has a remarkable future.

William H Morris (1981)

## A A B C O N T A C T S

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# COOL COME

By Mbou Eyole-Monono



Our reliance on an ever-growing set of computing devices from which we expect still greater marvels requires a strategy to combat the accompanying increase in energy demand. While the past decade has seen formidable advances in the speed and complexity of computers, it is only recently that we have looked for greater energy-efficiency. Computing's energy demand has long been a worry but it is only now that many have come to believe that to stick with our present technologies and programming methods will make further growth in performance unsustainable.

Thanks to fundamental physics, power usage and heat dissipation increase still faster than computer speeds (beyond a certain level). So it seems more efficient to have a computing platform in which two or more components work in tandem, if slowly, than one in which a single processor runs at a higher speed. So the makers of personal computing systems now deluge us with platforms

with more than one processing element sold in a single package. But some of us despair that no new model of computer will ever match our demand for more processing capacity.

Researchers are now discussing how a greater concurrency of operation—doing more things at the same time—might improve energy-efficiency. While there is agreement on the need for some form of concurrency, it is still unclear how much we need to overhaul our existing methodologies. One topic of debate is the structure and distribution of memory in multiprocessor hardware and what software paradigm will best make use of it.

The argument can be illustrated by way of analogy. In a brainstorming session the participants could either gather together to write down their ideas, exchange and modify them, all on the same large whiteboard—or they could each, separately, commit their thoughts to paper before discussing them with their colleagues. The first method is called *shared memory*; the second, *message-passing*. The choice between them influences the scalability and programmability of any multiprocessor platform.

In the short term the shared memory approach seems more attractive since it needs no radical change in hardware design. So work is going on to provide application programming interfaces that can cope with situations where several execution sequences, called 'threads', work collectively on a shared chunk of memory. However, even shared memory's fans, who like its simplicity, concede that it is ultimately inefficient for very large systems. This is because

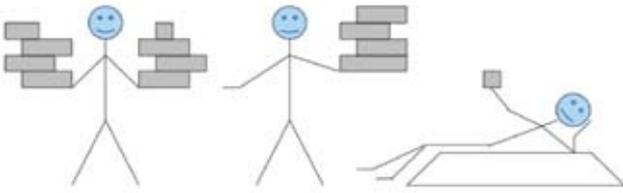
the common pathways within the hardware would suffer from increasing contention—as in a growing scrum around the whiteboard. Programs written for shared memory are also more subject to programmer error.

The alternative approach, message-passing, gets around these problems both by localising memory—that is, by writing one's thoughts down individually—and by requiring all communication between threads to use a scheme specifically designed to enable the threads to run without interference. Message-passing also helps to solve the sort of problems which, when broken down into a set of distinct tasks or threads, reveal irregular and dynamic relationships with the data they work on. My own research has focused on this second paradigm, to exploit the flexibility, scalability and robustness of its message-passing.

One of the key challenges in this parallel computing (as it is also called) is to ensure both that all available processors are working equally hard and that they communicate with each other as concisely as possible. *Load-balancing* generally meets the first requirement but all the processors still need to know what each of them is doing. The difficulty is that the energy cost of inter-thread communication is normally far higher than when a single processor performs many computing tasks. To reduce that cost we want to interleave each thread's (each processor's) internal computation tasks with their external communication needs. This overlapping is highly beneficial in energy terms, but it is also difficult to program since the different threads will exchange



# PUTTING



*Maximising utilisation is vital for improving energy-efficiency in multiprocessors*

information only along a network specially built for this purpose within the hardware. Communication speed (or delay!) depends on the exact network topology, bandwidth and the latency of the routers used. And even if one gave a suite of clever mapping programs called *compilers* the necessary communication skills, the network would need to be adjusted whenever the underlying hardware was modified. Worse still, the network might need to be altered in the middle of a computer operation—when one would have to resort to intolerably slow, low-level, multiprocessor management software.

The key innovation in my research stems from a realisation that the efficiency of parallel computing can be improved if the hardware is designed, from the start, to allocate tasks between processors, to balance their loads, and to facilitate their inter-communication. This hardware delivers inter-processor messages better, thanks to its tight coupling with the on-chip network. A second advantage is that a programmer has no need to know the multiprocessor's internal architecture. Thirdly, no programs (once written) would need major revision should the hardware be upgraded. One simply writes programs with abstract structures called *channels*, and the

hardware itself then creates and manages these channels while operating them. For example, in matrix multiplication, a common procedure in parallel programs, rather than manually

slicing the arrays into sets of data elements which can, one hopes, be operated on in concert, the program will simply load different parts of each array into several channels which are then consumed independently by a set of threads. The results are then plugged into another set of channels so that any further processing or collation and output of data can make use of the fact that communication and computation are indeed separate; so that they can be the more easily interleaved.

This scheme supersedes a *shared memory* approach which requires explicit memory management; in which a thread's numeric identity is mapped on to a particular array position, so causing the resulting program to lose any general utility. But my research may also improve upon traditional *message-passing* which, typically, requires that both message-sender and receiver are equally active. In my model, channels are filled with data asynchronously so that the 'producer' can get on with other work without waiting for other thread(s) which need its encapsulated data to open up the required channel. Parallel programs can be separated into different categories according to the degree of parallelism available to be exploited within the problem being solved. If the job of splitting a

given problem into smaller—hopefully independent—tasks is straightforward, then there will be few instances during the execution of a task when further progress depends on the completion of another task. My approach can handle still more challenging problems that contain a large number of cases where such *dependencies* need to be taken into account. If one does the load-balancing already described this approach can also cope with situations in which the different processing elements have different capabilities.



*Prototype hardware*

It is a challenge both to design the controlling hardware and to ensure that it does not itself become a communication bottleneck. However, our prototype hardware has provided promising results and insights on how to enlarge the scale of multiprocessor technology efficiently. Such scaling is being considered not just for tens of processing units but for hundreds, perhaps even thousands on a single chip. This would achieve an enormous increase in energy efficiency.

*Dr Mbou Eyole-Monono (2004) is a Junior Research Fellow, under Title 'A'.*

# TRINITY CAL

By Tony Bannard-Smith



If you picked up the phone to hear 'It's Trinity calling' you were taking part in history! At the end of the Lent term 2011, 14 students undertook two days of training and then bravely picked up phones for the next two weeks; they spoke to nearly 1000 Trinity alumni/ae about our Annual Fund. They found our non-resident members as proud of their College today as in their student years; so they enjoyed exchanging their anecdotes of the past with our hopes for the future.

The callers were following up a letter from the Master, Lord Rees, in which he outlined current issues and future ambitions, for the Annual Fund's purpose is to address immediate educational needs while preparing for the next challenges.

Trinity alumni/ae are very generous: 54 per cent of those of you we spoke to agreed to make a gift, with an average lifetime value of £736. When all these donations are received, the

College will have gained the additional resource of £395,523 from just 536 members, over half of whom are new donors. Your gifts will be applied to a variety of College activities, but chiefly for general student support—'the Master's most pressing need'.

### Why is Trinity raising funds?

Everybody knows that Trinity has great financial strength. What is less appreciated is that our longevity (694 years since the founding of one of our predecessors, the King's Hall), lends us both tenacity in facing the present, and the determination to master the ever more competitive path ahead.

Trinity's wealth is the product of past philanthropy and talented investment. Successive Senior Bursars have taken care to preserve our historic endowment capital by spending only the return received. This prudent approach is well suited to a stable environment, but nothing could be less stable than today's very dynamic higher education sector. Our College Council is all too aware of this and our most immediate concerns are bursaries, scholarships, and graduate studentships to support able young men and women who would not otherwise be able to fund their place at Trinity.

An exceptional investment track record (the Senior Bursar reports 14.9 per cent growth last year) enables the College to be ambitious and to think broadly of ways to sustain, indeed advance, the exceptional quality of Trinity's education and research. But tomorrow's new solutions require new funds, and even Trinity needs to muster new resources to ensure

not only our own but the University's relative independence from unwanted public pressures.

The College's fund-raising and development programme aims to help Trinity members by:

- reducing graduate debt through continued bursarial support as fees rise to £9,000 pa;
- sustaining the College's supervision system, not least by the recruitment of first-rate College Teaching Officers;
- adding to the research resources not only of our Fellows but also of our world-wide body of graduate students;

In addition, it helps Trinity to support wider initiatives in collegiate Cambridge, particularly through the Isaac Newton Trust.

Not everybody wanted to be contacted and we quite understand that. Some of you offered helpful advice, of which we will take due note, about how we could do things better. One member telephoned (!) to opt out of the scheme. During his call he learned more about why Trinity wanted to speak with him, and decided to receive a call after all.

### JOIN A 'GREAT COURT CIRCLE DAY'

Thinking about leaving a bequest in your will may seem depressing but my conversations at alumni events, including Annual Gatherings, suggest that to leave something to Trinity is a common thought in members' minds. And most find that a chat and a little guidance from the College (we have a brochure we shall be pleased to send out on request) is all they need to be reassured.



# LING

## A Caller's view

"One thing about the campaign that I wasn't expecting was the amazing stories I heard. I spoke to those whose relatives completed their degree in a prisoner of war camp, I spoke to friends of the mountaineering society that placed the car on the Senate House in the 1970s, and even to ones who climbed the roofs at night and bumped into the armed bodyguard of Prince Charles!

These two weeks have really been an experience, and I've made some fantastic friends. It's great that Trinity has such supportive alumni and I think this year's campaign has really made our efforts worth it. I would like to get involved again in the future, but perhaps next time I'll be on the other end of the phone!"

*Xinmei Wang (2009)*

## Recipients' viewpoints

"Living in California, we get a barrage of phone solicitations, from telemarketers



*Student callers meet the Master*

to recorded messages from politicians. The call from Trinity was a welcome change, particularly because of the interest shown by the caller in life after Trinity and what influence Trinity had on that life (me?). There was surprise

as to the random nature of life and shock (for her) that a meeting with the Cambridge Careers Advisory service could ever have had a decisive impact on one's life!"

*Stephen Johnson (1975)*



*The Calling room*

"I had been looking forward to the promised call from a student. When it came last night I had my story all prepared: anxious to help but with two teenage daughters approaching university, we need to save every penny. I am extraordinarily good at resisting appeals from 'call centres'. Yet this bright young lady, realising that she would not tap me for millions but still keen to get something from the call somehow had me reaching for my credit card and parting with money. Brilliant."

*Ian Daghish (1970)*

Ian is quoted here by the very kind permission of Mrs Joy Daghish.

# SEVEN MYTHS ABOUT CAMBRIDGE ADMISSIONS

By Paul Wingfield



A YouGov poll shows that a majority of the UK public does not want universities to lower standards for state-school entrants but also wants them to meet targets for state-school admissions. Governments also condemn Oxbridge for drawing two-fifths of their intake from independent schools; some politicians advocate positive discrimination for state-school candidates. Analysis of Cambridge admissions data over the last eight years suggests that seven myths sustain such contradictory views.

**Myth 1 – Cambridge cannot, on paper, distinguish the best applicants.** Admissions tutors are said to be bamboozled by schoolteachers' inflated A-level predictions for their star pupils. But since A-grades span a wide range of marks we require applicants to disclose their percentage marks, not merely grades, and A-level percentages are equally good predictors of undergraduate performance for candidates from both school sectors.

But many still believe we resort to magic to discover 'potential':

**Myth 2 – Interviews tease but aptitude tests reveal 'potential'.** Each year the press prepares Cambridge applicants for bizarre interview questions like 'tell me about a banana'. Journalists think we believe such tricks reveal 'potential'. They suggest that aptitude tests would indicate this elusive quality more reliably than A-levels, especially in bright state-school students from deprived areas. But neither interview scores nor aptitude tests have the same predictive consistency as GCSE results or marks for A-level modules.

**Myth 3 – Cambridge fails to identify the large pool of untapped state-school potential.** Cambridge annually admits 3,500 undergraduates. In 2010, an A\* grade was introduced at A-level. Successful 2009–10 applicants achieved an average of 2.5 A\* grades. Fewer than 8,000 students in England attained this level; Cambridge admitted about a third of them. Moreover—since the proportion of state-school students gaining A\* grades in unsuitable subjects (Photography, Media Studies etc.) was twice that of the independent sector—around two-fifths of qualified A-level students are in any case from independent schools. 'Untapped state-school potential' is therefore scarce. So, does Cambridge make unreasonable demands over A-level subject-choice?

**Myth 4 – A blacklist of A-levels is divulged only to independent schools.** No! The University website advises on preferred subject choice, according to applicants' choice of Tripos. Trinity has an 'Acceptable A-level Combinations'

page on our own website.

**Myth 5 – Cambridge favours independent schools.** The press often portrays admissions tutors as tweedy Bufton-Tuftons keen to perpetuate their breed. This myth forgets that independent schools have long offered bursaries to talented children unable to pay full fees. Nearly 30% of Trinity's Home students now receive College bursaries, and two-fifths of these have been independently educated. So we are pressed to discriminate against those talented enough to have won school bursaries! This counter-productive pressure rests on a further myth about how differently educated students perform at Cambridge.

**Myth 6 – State-school students do better at Cambridge than similarly qualified independent-school students.** In fact, A-level percentages and subsequent Tripos performances are virtually identical for both school sectors. Disappointed myth makers resort to a final, contradictory, untruth:

**Myth 7 – The performance of state school students improves when at Cambridge while that of independent school students declines.** This assumes that admissions tutors dazzled by tweedy dullness can nevertheless unerringly detect talent beneath the denim. Evidence again demolishes myth. State-educated undergraduates do not overtake the privately educated. The average progress of each group is much the same.

Can evidence trump myth? Alumni now have the facts with which to undertake that experiment!

*Paul Wingfield (1990), Tutor for Admissions*



# IN MEMORIAM: KHALIL MOHARRUM ALI SHEIKH

(born c. 1970, died 6 June 2010) • By Yug Mohit Chaudhry



*Yug Mohit Chaudhry*

Khalil was a convict prisoner in Kolhapur Central Prison and died, aged about 40, whilst undergoing treatment at Kolhapur Civil Hospital. After his conviction in 2006, he had written to me from prison seeking legal assistance with his appeal in the Bombay High Court<sup>1</sup>, and we began corresponding. His mother and sister visited me to help get Khalil released. I never met him but am more troubled by his death than by the deaths and suffering of other clients in jail. His disturbing story just refuses to die with him.

Khalil had scraped a living off Mumbai's pavements to feed his family. He was arrested on 27 December 2004. The police claimed he had committed robbery and murder 10 years earlier, and that he was an illegal Bangladeshi immigrant. The case was extremely weak, depending

<sup>1</sup> While the city's name was changed to Mumbai late in the last century, the news has not yet reached the Bombay High Court (Ed).

solely on the word of a 12-year-old child who was 2 years old when the incident occurred. The police claimed that the child, unprompted, had recognized Khalil as one of the assailants 10 years later, at an identification parade. Bizarrely, the Sessions Court believed the prosecution story and convicted Khalil

of robbery and murder, but acquitted him of being from Bangladesh. Khalil filed an appeal in the Bombay High Court in 2006.

Khalil's was one of the easiest cases I had met; I had no doubt bail would be a formality and that he would be acquitted. However, his family took a long time to provide a surety, so it was only in December 2007 that I could apply for bail. When the facts were put before the Court, the judges felt that the appeal could be decided there and then, instead of waiting in a 5-year queue. The papers were summoned from the trial court, but they took ages to arrive, and meanwhile the court allowed me to move Khalil's appeal out of turn. He had already been in jail for over 4 years. Then, before the appeal could be moved for final disposal, Khalil started complaining of breathlessness. He was taken to hospital, where he underwent major heart surgery at government expense. A jailor's

prompt intervention had saved his life. Thereafter Khalil revisited hospital whenever possible, subject to the jail's budgetary and staffing constraints. It was then that his family asked me if we should persist with trying to expedite his appeal since, were he released, they would be unable to pay for his treatment. I was being asked to delay a prisoner's release, clean counter to my most basic professional duty. I wrote to Khalil and he agreed that it would be better not to litigate his appeal just yet. Perhaps I ought not to have acted on these instructions, but I did.

In 2009, Khalil complained of ill-health and I asked the jail for copies of his medical papers. There was no reply. I wrote to the jail again when Khalil's next letter arrived with further news of his ill health. Again there was no reply. His mother scraped together the money to visit him. He told her he was receiving treatment and was feeling better. His family again asked me not to move his appeal for final disposal since the treatment he received in jail was better than they could afford outside. On 30 May 2010, Khalil was re-admitted to hospital. The jail wired his family. They immediately left for Kolhapur. By the time they arrived Khalil had lost consciousness, and the doctors had given up hope. Khalil died five days later. He had been in jail for six years. He is survived by his wife, mother and three children.

*Dr Yug Mohit Chaudhry (1998) is an advocate practising in the Bombay High Court. This article is adapted from one originally published in the Mumbai Mirror on 11 June 2011.*

# LIGHT

By Peter Littlewood



Vision sends far more data to the brain than any other sense. Much scientific experiment involves enhancing our vision—from telescopes to microscopes. Vision so informs our conception of the world that we confuse it with meaning: a clear argument is ‘transparent’; to ‘see’ is to ‘understand’. Humans have long wondered about vision’s substance, light itself. In that struggle for understanding two of Trinity’s greatest scientists played leading roles.

What medium leads to vision? In antiquity men made no distinction between sight and light: Euclid and Ptolemy believed the eye saw by emitting rays of light. But Aristotle, after performing elementary experiments using coloured glass to filter light, believed that physical forms entered the eye from an object. But having struggled to the first step of the scientific method, he called off further pursuit, declaring:

*Light is nothing of substance. It is*

*indefinable, featureless, and it is therefore pointless to contemplate its nature.*

Matters stood roughly there until Alhazen-al Basri (965 – c 1039) who could fairly claim to be the first experimental scientist. The Caliph employed him in Cairo to regulate the Nile’s floods. Having predictably failed, he escaped his master’s anger by feigning madness and lived thereafter under house arrest. With time on his hands, he experimented in optics. He proved Aristotle’s ‘intromission’ theory; discovered that light rays travel in straight lines; studied lenses, mirrors, refraction, and visual perception as well as light’s ‘dispersion’ into constituent colours; invented the pinhole camera; and argued that light rays were particles, so that their speed was not infinite. His *Book of Optics* contains a strikingly modern description of experimental method:

*We should distinguish the properties of particulars, and gather by induction what pertains to the eye when vision takes place and what is found in the manner of sensation to be uniform, unchanging, manifest, and not subject to doubt.*

*After which we should ascend in our inquiry and reasonings, gradually and orderly, criticizing premises and exercising caution in regard to conclusions—... and to take care in all that we judge and criticize that we seek the truth and not be swayed by opinion.*

The Arab scholar thus described light by mathematics—geometrical optics. The translation of Alhazen’s book into Latin allowed the invention of eyeglasses in thirteenth century Italy and, eventually, the telescope and

microscope. When Galileo learned of Hans Lipperhey’s invention of the telescope in 1609 he rushed to build his own and turned it to the heavens, the date when modern experimental science began in the West. Without knowing what light **was**, it had become a tool, one we still use to explore the farthest reaches of the universe.

Light’s nature remained unresolved. Before Newton, its colour was assumed to be ‘painted’ onto the ray by passage through glass. Newton’s famous experiment (performed in his Great Court room) to split white light into its spectrum with one prism, and to **recombine the light with a second** showed that colour is a separate quality of light:

*“Colours are not qualifications of light derived from refractions or reflections of naturall bodies as ’tis generally believed, but originall & connate properties, which in diverse rayes are divers, some rayes are disposed to exhibit a red colour & noe other, some a yellow & noe other, some a green & noe other & so of the rest. Nor are there only rayes proper & peculiar to the more eminent colours, but even to all their intermediate gradations.” (A Theory Concerning Light and Colors 1671/2)*

Newton believed light was a particle; he explained refraction by the variation in speed of particles corresponding to rays of different colours. Huygens and Hooke thought differently; Newton was so offended that he withdrew from public debate and did not publish his great work on Optics until after Hooke’s death in 1703. But Huygens, in particular, got it right.

Newton’s influence was such that it took a century to correct his error,



with Thomas Young's famous experiments demonstrating that light waves emitted from two point sources ('Young's slits') would interfere in a wavelike fashion. However, as any scientist will know who has tried to publish a breakthrough result, Young had to get his paper past a referee, attracting the following acerbic comment

*"...this paper contains nothing which deserves the name, either of experiment or of discovery, and ... is, in fact, destitute of every species of merit..."*  
(Lord Brougham in a review of Young's 1802 paper)

There was still no theory of light's **substance**. That awaited the second great Trinity physicist in this story, James Clerk Maxwell. By the mid-19th century, a separate scientific endeavour had codified the laws of force due to electricity and magnetism, seen as separate phenomena. But Michael Faraday, in a lovely series of experiments that gave us the electric dynamo, showed that magnetism and electricity were in fact related. Maxwell then saw an analogy between Faraday's magnetic field lines and those of fluid flow. He exploited this analogy as a mechanical one, with space being occupied by rotating vortices (the field lines), and charged particles lubricating the counter-rotating flows. With this Heath-Robinson-like contraption to describe the 'ether', he realised he could work out the speed at which waves could travel through space. To his amazement, he found the speed of light, recently measured with high precision by Foucault. In his words,

*'We can scarcely avoid the inference that light consists in the transverse modulations of the same medium which is the cause of electric and magnetic phenomena.'*

In 1864 Maxwell developed the theory on a more abstract basis without any prior assumptions about the nature of the medium through which electromagnetic phenomena are propagated. He stripped away the scaffolding of the theory, the cogs and wheels, and left us with just the wave equations, known evermore as Maxwell's equations. We now understand, better than at the time, that his work is a staggering achievement: the first 'unified field theory', unifying the forces of electricity and magnetism and expressing them as 'fields' that permeate empty space. Fields are the framework with which physicist have described the universe ever since. His theory also held the seeds of Einstein's special theory of relativity, since the speed of light is indeed invariant and there is no special frame of reference. Unlike Newton's laws of motion, Maxwell's equations require no modification to account for relativity.

Maxwell left us with a fully mechanical if somewhat mysterious theory of light. But there were yet more mysteries to be uncovered. Heinrich Hertz tested Maxwell's theory in a set of experiments generating radio waves. They agreed perfectly but, almost as an aside, Hertz noticed another phenomenon, the photoelectric effect. He discovered that the energy of electrons emitted from a metal illuminated by light

depends on the light's frequency, not its intensity. Einstein seized on this result as a principle: light is emitted in 'quanta'; so quantum theory was founded. The existence of elementary particles—of which the photon of light is one—simultaneously as waves and particles is perhaps the most bizarre yet also the best-tested theory in physics. So bizarre is quantum mechanics that we are still struggling to comprehend and exploit it—one more trick of the light.

If you create two photons together, they may emerge 'entangled' since the superposed waves of each photon overlap in indeterminate ways; the photons themselves are indistinguishable. They remain entangled even as they travel apart in opposite directions: but since we know the pair's collective properties, to measure a property of one photon is to instantly determine the corresponding property of the other, even if it has travelled to the other side of the galaxy. This idea seems so ridiculous that Einstein, Podolsky and Rosen published it as a 'thought experiment' in 1935, to refute quantum theory. But today Einstein's 'spooky action at a distance' is the foundation of emerging technologies in quantum cryptography and quantum computation.

Light, our window on the universe, has yielded its remarkable secrets reluctantly; and our theories of the universe turn out to be inseparable from our theories of how we 'see' it.

*Peter Littlewood FRS (1973) is Professor of Physics*

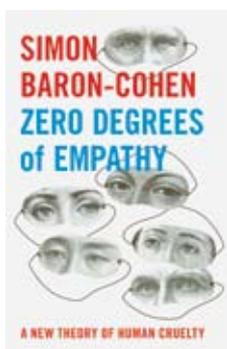
*Traditionalists forget that they owe their traditions to their iconoclastic ancestors.*

# NEWS OF FELLOW MEMBERS

**Philip Allott's** (1955) two *Invisible Power* philosophical novels have become available on Kindle. The third, and last, is due to be published later this year. They are about a benevolent conspiracy of influential people who refuse to wait for governments to resolve the world's problems. They take the task into their own hands. The novels have several hundred pages of *Allusions Explained* in the form of endnotes, reminding the reader of the historical and cultural background.

**Michael Banner** (2006), Dean of Chapel, will give the Bampton Lectures (inaugurated in 1780) in Oxford in 2013. His provisional title is 'Imagining Life: Christ and the Human Condition'. Among the questions he will address are: how do the moments of Christ's life as evoked in the Creeds, and as reflected in theology and sermons, in prayers and liturgy, in art and literature, represent human life, and how does this representation relate to present-day cultural norms and expectations?

The controversial *Zero Degrees of Empathy: A new theory of human cruelty* (Penguin)—re-titled *The Science of Evil* by Basic Books in the USA—by **Simon Baron-Cohen**



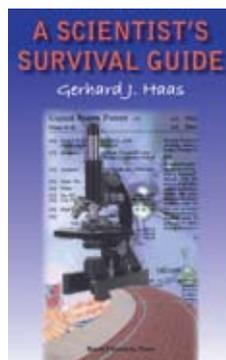
**Cohen** (1995) has been widely reviewed in the daily press. Simon proposes that the term 'evil' be replaced by 'empathy

erosion' and so moves the discussion from religion to neuroscience. A zero degree of empathy is the cause of human cruelty, and his book explores how the empathy circuit in the brain can be temporarily or permanently shut down, and what determines why each of us ends up at different points on the empathy bell curve.

\***Richard Blumenthal** (1967) defeated a professional wrestling magnate (and occasional lady wrestler) to be elected Democratic Senator for Connecticut.

**Nicholas Denyer** (1983) has joined the telly-dons, telling us how upright ancient Athenians despised the luxurious decadence (*habros*) of their Persian enemies, in the first episode of the BBC4 series on 'The Story of Luxury'.

\***Gerhard Haas** (1936), one of our refugees from Nazi Germany, tells of life at Trinity in his memoir *A Scientist's Survival Guide*. He also remembers his work with the pioneers of the oral contraceptive and then as a microbiologist and enzymologist, with 28 patents to his name and ethical challenges explored.

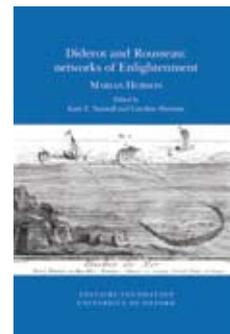


The retirement of **Boyd Hilton** (1974) was honoured in July by a conference entitled 'Time! Time! Time! The pace of

change in Britain 1780 to 1870', organised by the Cambridge Victorian Studies Group.

SVEC (Studies in Voltaire and the Eighteenth Century) has published, in English translation, seminal essays on French texts and their polemical context

by **Marian Jeanneret Hobson** (1977), Trinity's pioneer female Fellow and now Professorial Research Fellow at Queen Mary University of London. The editors of *Diderot and Rousseau: Networks of Enlightenment* are two of her former students, both now teaching at Oxford, Caroline Warman (Trinity 1988) and Kate Tunstall.



**Hugh Hunt** (1990) led the Cambridge engineering team that recreated Barnes Wallis's dam-busting bomb. Hugh's



bomb was tried out on Trinity's Backs and then dropped with gratifying results on a Canadian lake, for a Channel 4 documentary. The original 1940s data on both the bomb and the RAF's means of dropping it has been lost; this was the only way to rediscover how the legendary feat was achieved. Hugh is also involved in SPICE, (Stratospheric Particle Injection



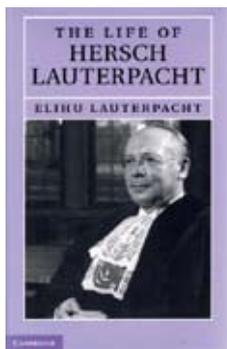
# S AND OTHER

for Climate Engineering) which looks at how to cool the planet by 2 degrees in the event of serious global warming. Find out more at <http://www2.eng.cam.ac.uk/~hemh/tv.htm> and <http://royalsociety.org/Geoengineering-the-climate/>

**Matthew Juniper** (2006) has won a Visiting Prize Fellowship at the Technische Universität in Munich, to examine problems in fluid mechanics and thermo-acoustics. The European Research Council has also awarded him a five year €1.3m research grant, for research into how to translate techniques from the field of Optimal Control into real life engineering applications, for example, to calculate the disturbance most likely to create turbulence on an aircraft wing. As a Visiting Professor at the Ecole Centrale in Lyon he will also work with Professor Benoit Pier on fundamental hydrodynamic stability.

## **Eli Lauterpacht**

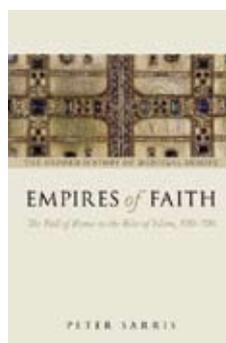
(1945) has published with the Cambridge University Press a biography of his father Sir Hersch Lauterpacht (Fellow, 1937 to 1960), a distinguished international lawyer who played a key role in Anglo-American relations during the Second World War and was on the British team at the Nuremberg Trials in 1946.



**Jo Miles** (1999) has become an academic door tenant (not as menial as it sounds) at 1 Hare Court, a family law barristers' chambers; and has joined the editorial team of the *Child and Family Law Quarterly*. The second edition of her textbook on family law (co-authored with Sonia Harris-Short) came out earlier this year.

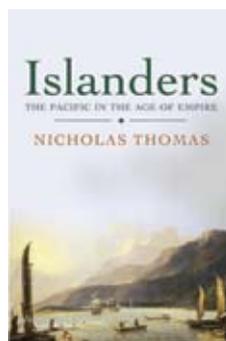
## **Peter Sarris**

(2000) has published *Empires of Faith: The fall of Rome and the rise of Islam, 500–700* in the Oxford History of Medieval Europe. He deals with Europe, the Mediterranean, and the Near East; with war, grain, and plague; kings and saints, caliphs and peasants.



## **Nicholas Thomas**

(2006) has won a Wolfson History Prize for his book, *Islanders: the Pacific in the Age of Empire*. While conventional accounts focus on the destruction of indigenous cultures, Nick's theme is the mobility and imagination of the peoples of the Pacific, and their creative responses to the possibilities offered by commerce and Christianity.



To prove the poetry of mathematics and humanity of mathematicians **Keith Moffatt** (1957) offers this cosmological rumination:

### **Genesis: Cosmological Echoes**

*There was a time when Time itself stood still*

*And Triune Space was formless, void and vast;*

*No matter stirred; there was no eye to see  
Nor mind to comprehend the vacant past.*

*And yet within this carapace of calm,  
In subjugation to the laws of chance  
Dark Energy lurked stealthy in the shade,  
Provoking random waves in ghostly dance.*

*As when Earth's winds and ocean waves  
conspire*

*To focus energy in gathering storm,  
In hurricane of chiral power immense,  
Or maelstrom far exceeding any norm,*

*So these primordial space-time waves  
converged*

*With flux of energy t'ward caustic point,  
Focus of pressure infinite, intense,  
Where graviton and photon were conjoint.*

*Such fusion of extremes could scarce endure:  
Explosive stress induced chaotic schism,  
Releasing pent-up energy as mass  
In sonoluminescent cataclysm.*

*There was a time when molecules converged  
In replicative mode precursing Life,  
Genetic coding, helices that merged,  
A spiral staircase to our world of strife.*

*Dark Energy still roams athwart the bound  
Where lightning flits and quarks have  
ceased to churn,*

*That sphere in spectral darkness all  
begowned,  
That bourne from which no echo can return.*

\* Members who are not or have not been Fellows.

# CHOIR TOUR AND

## Trinity Choir Down Under

1 country, 3 programmes, 7 states, 13 concerts, 28 days, 31 choristers, a million sandwiches... and NO sheet music...

Last year's choir tour was in Australia as part of the Musica Viva International Concert Season. The choir spent almost a month travelling round all the major cities, and performing to several thousand Australians in some of the finest venues across the country, starting in Tasmania and finishing in Perth. The *a-cappella* first half of the concert programme was a mix of Renaissance polyphony from Tudor England and modern works by contemporary European composers, from the Baltic states and Scandinavia. Before the interval we concluded with Sven-David Sandström's reworking of Purcell's incomplete anthem *Hear my prayer*, nicely fusing the modern and the ancient in one spectacular and show-stopping work.

The opening work of the second half was Australian composer Paul Stanhope's *Deserts of Exile*, written in 2007. Paul Stanhope joined the choir onstage at several of the concerts to talk about his work, which combines the Lamentations of Jeremiah with texts from the Palestinian poet Jabra Ibrahim Jabra (1919–1994).

*"The technical facility of these fine musicians is without question. Paul Stanhope's affecting Deserts of Exile, from his Exile Lamentations (2007)... is a singularly great work performed by an exceptional choir."* – Kevin Purcell, *The Australian*, 26 August 2010.

Following the Stanhope we presented alternate second half

programmes – one with organ and the other a mixture of piano accompaniment and *a-cappella* works. Organ scholars Michael Waldron and Simon Bland played Britten's *Rejoice in the*

*Lamb* and Walton's *The Twelve* on the organs at Brisbane Performing Arts Centre, Adelaide Town Hall, the Llewellyn Hall in Canberra and Perth Concert Hall.

Despite the complexity of the programmes to be performed on the tour, the Choir did not take a single sheet of music to Australia; all three programmes were sung from memory. While this was quite a challenge for Choir members, the effect on the audience was amazing, since we were able to communicate and engage with them so much more immediately.



*The Choir with the Governor General following their performance at Government House, Canberra*

Several of the concerts were recorded as both live and delayed broadcasts for the Australian channel ABC Radio. Two choir members – Ros Hindmarch and Timothy Carlton Jones – also appeared on ABC Radio's *The Music Show* to talk about our Trinity choir, the choral world of Cambridge and the repertoire we had taken on tour.

More information, photos and reviews of the Australia tour are available on the Choir's website: [www.trinitycollegechoir.com](http://www.trinitycollegechoir.com).

*Joanna Harries, Choir volunteer 2009–2011*



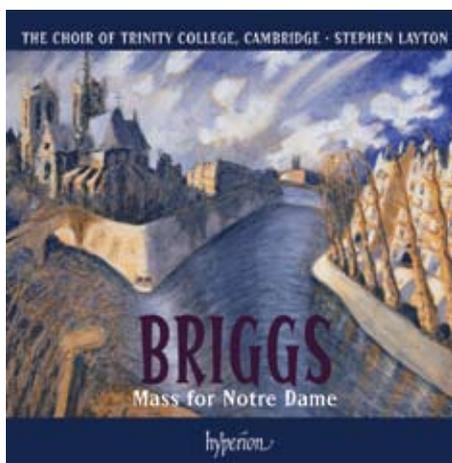
*Trinity Choir outside Sydney Opera House*



# D RECORDINGS

## Trinity College Choir named the fifth best choir in the world by *Gramophone*

For their January 2011 issue, *Gramophone* magazine invited a panel of the world's leading critics to create a list of the 20 greatest choirs in the world. Trinity College Choir was named the fifth best choir in the world and praised for their '150 per cent commitment to the music'. The top five choirs were 1) The Monteverdi Choir, 2) Polyphony, 3) The Cardinal's Musick, 4) The Sixteen, and 5) Trinity College Choir.



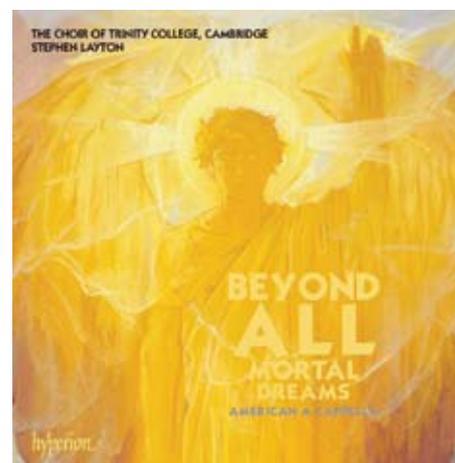
The Choir's recording of music by David Briggs **was awarded the Jury Award for Technical Excellence at the 2011 BBC Music Magazine Award.**

The award was given at a ceremony in King's Place, London, presented by Radio 4's James Naughtie and *BBC Music Magazine's* editor Oliver Condy.

## Latest release by the Choir

*Beyond all mortal dreams* is a showcase of a-cappella works by American

composers. It was John Suchet's CD of the Week on Classic FM in July and *Classic FM Magazine* named it CD of the Month in their August issue, saying: 'First, a health warning: it is impossible to do anything else but listen once the opening track of this glorious album begins... Here is music-making of the highest quality... I don't have the space to mention all of the choral wonders on this disc, but I can say with certainty that it is an album that will repay repeated



*listening for years to come.'*

For further information about this and all recent Choir CDs see [www.trinitycollegechoir.com](http://www.trinitycollegechoir.com). Copies can be bought directly from the College, in aid of Trinity College Choir Fund, by sending a cheque for £13.99 per CD (including P&P), payable to 'Junior Bursar Trinity College', to the Chapel and Music Office, Trinity College, Cambridge, CB2 1TQ.

## Forthcoming College Choir concerts

Following their critically acclaimed debut performance in last year's Christmas Festival at St. John's, Smith Square, London, the Choir will perform two seasonal concerts in the 2011 Festival. *Tickets will be available from the St. John's, Smith Square box office: 020 7222 1061/www.sjss.org.uk from 3 October.*

Monday 19 December – the Choir performs Britten's dramatic St Nicolas with tenor Allan Clayton, City of London Sinfonia, the Holst Singers and boys from the Temple Church

Choir. Britten's magical *Ceremony of Carols* completes the programme, with harpist Sally Pryce.

Thursday 22 December – the Choir joins forces with the Orchestra of the Age of Enlightenment and an outstanding line-up of soloists, to perform Bach's *Christmas Oratorio* (Parts 1, 2, 3 and 6). This concert will be preceded by a reception for Trinity members.

## Friends of Trinity College Choir

Trinity College Choir Fund supports the Choir for all its activities beyond

its primary function of singing the services in Trinity College Chapel. The high-profile concerts, tours and recordings undertaken by the Choir in recent years have all been made possible thanks to support from the Fund.

The new Friends of Trinity College Choir scheme, an integral part of Trinity's Annual Fund, allows regular giving to the Choir at two different levels. Further information is available on the Choir website [www.trinitycollegechoir.com](http://www.trinitycollegechoir.com) or from the Alumni Relations Office.

## FORTHCOMING EVENTS

**25 September 2011 Seventh Annual Members' Luncheon** in Neville's Court.

**11 October 2011 Trinity Engineers Association meeting** will be followed by a dinner in the Old Kitchen.

**13 October 2011 Trinity in the Arts & Media Association 'Insights' meeting**, London

**13 November 2011 Remembrance Sunday Service** followed by a luncheon for former and current members of the Armed Forces.

**8 December 2011 Varsity Match at Twickenham.** Details of this year's special package are still to be confirmed but do contact the office if you are interested in attending the event.

**12 December 2011 Alumni Carol Service** in London to be followed by mince pies and mulled wine

**22 December 2011 Trinity Choir Concert at St John's Smith Square.** There will be a Drinks Reception for Trinity members before the recital.

**21 April 2012 Trinity Faiths Association meeting** with lunch, Trinity College

## ANNUAL GATHERINGS

**Saturday 7 July 2012—(1990–1991)**

**Wednesday 18 July 2012—(1980–1981)**

**Friday 14 September 2012—(2000–2001)**

Choral Evensong at 6.30pm

Dinner at 8.00pm

*Invitations for Annual Gatherings will be sent out at least three months in advance.*

For further information about Annual Gatherings or any of our other events, please contact the Alumni Relations Office at [alumni@trin.cam.ac.uk](mailto:alumni@trin.cam.ac.uk) or on +44 (0)1223 761527.

## THE TRINITY CAROL ROLL

This autumn the first ever recording is being made of the earliest surviving collection of English polyphonic carol music. The Trinity Carol Roll has been so called for many years, although the term 'carol' has itself changed in meaning. The roll closes with the well-known carol 'There is no rose', but, in the middle, the 'Agincourt song' celebrates Henry V's victory over the French in 1415.

The roll dates from c. 1420–1430. Over two metres long, it is about 18 cm wide. It comes probably from southern Norfolk or northern Suffolk and was given to Trinity in 1838.

The recording, made in the Wren Library, will feature a former member of the choir, Clare Wilkinson (1995), directed by Dr David Skinner, director of music at Sidney Sussex and celebrated for his work with early music. The recording (on the Obsidian label) should be released before Christmas.

*David McKitterick (1986), Wren Librarian.*

## UNBALANCED

'Cambridge has a very unbalanced demographic – there's an unnaturally high concentration of extremely clever people.' [News item]

*There is a lot that's wrong with Cambridge, yes.*

*Houses are too expensive and too thin.*

*The Clifton Leisure Park is nothing less*

*Than standing proof that a grave mortal sin*

*Can be committed by a multiscreen*

*Cinema, allied with a Travelodge.*

*Cambridge street is no idyllic scene.*

*Sometimes, on King's Parade, I have to dodge*

*Tourists who want to bash me in the face*

*With their huge cameras. I contain my rage,*

*Remind myself that I don't own the place;*

*I must play nice and share my*

*Chronophage<sup>1</sup>,*

## LEONARD BROOKS, CEDRIC SMITH, ARTHUR STONE, WILLIAM TUTTE

Seventy-five years ago this year, four first-year members of the Trinity Mathematical Society set out on an adventure to examine a puzzle that mathematicians had been unable to resolve in over 25 years. They adopted a collective nom-de-plume of Blanche Descartes. The route by which the problem was solved was remarkable in itself. It also produced what has been called the foremost intellectual achievement in World War Two. Would you know of anyone with recollections of Blanche Descartes or college life, or indeed both, in the period 1935 to 1948? The Blanche Descartes research project would like to know of them. Should you wish to contact us, please write to Bela Bollobas FRS at Trinity, or email him at [b.bollobas@dpmms.cam.ac.uk](mailto:b.bollobas@dpmms.cam.ac.uk).



*And thank my stars – hemmed in  
by Hills Road traffic,  
I savour the unbalanced demographic.*

*Sophie Hannah, Fellow Commoner in  
Creative Arts, 1997–1999*

*1 the time-eating locust at the top of the Corpus clock*