Oxford Mathematical Institute Spring 2012, Number 10

Newsletter

We hope that you enjoy receiving this annual *Newsletter*. We are interested to receive your comments, and also contributions for future *Newsletters*.

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Design & production by Baseline Arts

KEEP OUT!
Ill-informed visitors to the Institute building site are discouraged from entering, by a large notice in Greek featuring Plato's warning 'Let no one destitute of geometry enter my door'.

Top right: Sam Howison (Department Chairman) realises a lifetime's ambition

Right: Nick Woodhouse (former Department Chairman), Sam Howison, Lavinia Clay (benefactor), Sir Andrew Wiles and Ewan McKendrick (University Registrar) start to dig out 43,000 tonnes of earth from the basement of the new building

The earth moves

Construction has begun on the new Mathematical Institute building on the Radcliffe Observatory Quarter, after a ground-breaking ceremony on 2 August.

The building is due to be completed in June 2013. It will house a substantial enterprise – in particular, about 1 in 11 of all undergraduates reads for one of our degrees, and the new Institute will give them much better facilities. It has been designed by Rafael Viñoly Architects and is being constructed by Laing O'Rourke.

The development represents a landmark step in mathematics at Oxford University, bringing together researchers from three separate buildings into a single dedicated faculty. The new Institute building, with more than 300 offices, will house lecture and seminar spaces, meeting rooms and a large departmental common room. It will be the main workplace for more than 500 academics and support staff, as well as providing the focus of academic life for nearly 1000 undergraduates and a diverse community of college research fellows and lecturers. It will also enable members of the mathematics department to increase their outreach work. ■

Daniel Quillen (1948–2011)

Waynflete Professor of Pure Mathematics and Fellow of Magdalen College (1984–2006)

A personal tribute by Sir Michael Atiyah, OM, FRS

Dan Quillen was part of the reverse brain-drain, Americans who left the US and settled in Britain: he was very far from being the standard American academic in pursuit of ever larger salaries. He settled in Oxford, with his wife Jean and their six children, because he liked the more sedate intellectual and cultural atmosphere. He had three passions in his life – his family, his mathematics and his music – and Oxford was in his judgement the place where they could all flourish.

I first met Dan at Harvard when he was a graduate student of my close friend and collaborator Raoul Bott. I remember Dan then as full of boyish enthusiasm, with bright eyes and terrier-like tenacity. His boyishness never left him and saved him from becoming in later life a staid professor.

Dan was an individualist, going his own way, but very much influenced by the leading figures of the time. From his supervisor Raoul Bott he acquired a large eclectic view of mathematics, with beauty in the foreground and a grand vision beyond. For a while the French school of Serre and Grothendieck, with its elegance and power, greatly attracted him and helped to form his own philosophical approach. In Oxford he was surrounded by geometers of various descriptions where he was, in a broad sense, at home but he enjoyed being left to develop his own individual ideas.

This is not the place to record or assess in any detail his many original mathematical contributions, but I would like to convey something of the spirit and style of his work. Typically Dan would identify a topic that interested him, immerse himself very deeply in it, perhaps for several years, and then emerge with a beautifully crafted paper, full of new and creative ideas. He did this time and time again, in geometry and associated algebraic structures. His influence has been enormous and he has left his mark on the mathematics of our time.

Photo by D. Schori

Daniel Quillen

Although he solved many famous problems his most important work, recognized by his 1978 Fields Medal, was his development of higher algebraic *K*-theory. This had its origins in the work of Grothendieck in algebraic geometry, the follow-up in topology by Hirzebruch and myself (based on the Bott periodicity theorem), and preliminary work of Milnor with links to number theory. But Quillen's contribution was extraordinarily simple and universal. The Quillen *K*-groups are now central to a vast domain of algebra, number theory and geometry and have generated great visions for the future. Many conjectures have been built on Quillen's framework and will keep mathematicians busy for decades to come.

Although Dan was well versed in the grand developments of the time he was never part of a 'mathematical school'. He remained his own man and never joined the latest bandwagon. This was, to some extent, a reflection of his personality. Unlike his charismatic mentor Raoul Bott, he was a quiet person who liked to think on his own. Few of his papers are jointly authored. This was both a weakness and a strength. Being part of a team can be very productive, but it reduces the role of the lone thinker. Mathematics needs all kinds of thinkers, and individualists like Dan Quillen are badly needed. ■

Oxford's Fields Medal winners: Michael Atiyah, Simon Donaldson and Daniel Quillen

Quillen Memorial Meeting

A special meeting took place on 19 November in the Grove Auditorium at Magdalen College to celebrate the life and work of Daniel Quillen. The organizers were Martin Bridson, Frances Kirwan, Glenys Luke, Graeme Segal and Ulrike Tillmann, and the invited guest lecturers were Michael Hopkins (Harvard), Graeme Segal (Oxford) and Sir Michael Atiyah (Edinburgh). The proceedings concluded with a concert, a reception and a dinner. ■

Memorial Fund

We're collecting contributions for a room in Dan Quillen's honour in the new Mathematical Institute, to house the large collection of his notes; a list of donors will be kept in the room.
To contribute, please go to *www.giving.ox.ac.uk/maths* and select *The Dan Quillen Memorial Fund*, or, if you wish to use a form, please use the one enclosed or download one from *www.maths.ox.ac.uk/giving*. If using a form, please note that you wish the gift to go to the Dan Quillen Memorial Fund. Please also consider claiming gift aid, which can increase the value of your gift by 25% or more. ■

Chairman's letter

What a difference a year can make! Since I last wrote, the University's Council has given us the go-ahead for our new building and work has started.

Our planning is no longer hypothetical: the design choices we make are what we shall get, from lecture theatre layout to door handles. What we actually have, at the time of writing, is the biggest hole-in-the-ground in Oxford. Work started with the ground-breaking ceremony in August of last year, and by January the contractors had excavated down to ten metres below ground across the whole footprint of our site. It won't take long to fill the hole, though: topping-out of the frame is due at the end of this coming August, with the building to be filled in, clad, and fitted out by the following June.

The other big event on the horizon is the Research Excellence Framework (REF) assessment, due in 2013–14. Along with all other UK universities, we shall be assessed on the quality of our research and the environment we provide for it. A new feature this time, compared with the previous exercise in 2008, is that we and our colleagues in Statistics have to write 15 'impact case studies', explaining the impact that our work has had outside academia. It remains to be seen how easy this is to do.

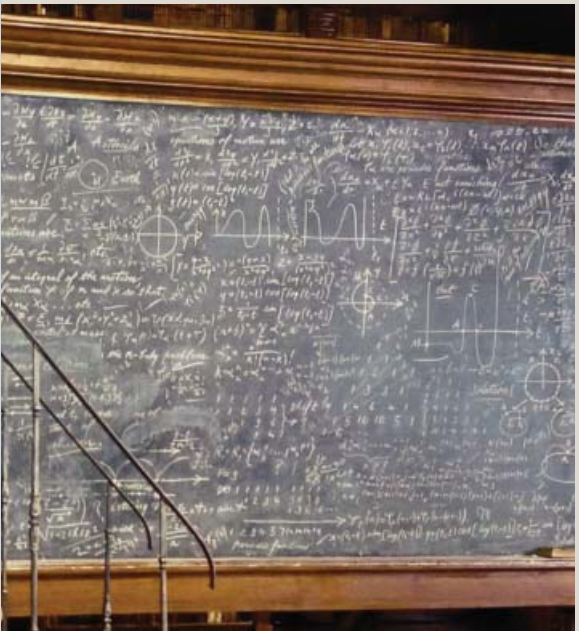
Mathematics has a huge impact on society, in ways that are often unforeseen and hard to document within the REF rules. But you only need to consider the RSA encryption algorithm, or Google's PageRank, to see that sophisticated mathematics can have huge economic value; these two examples are just the tip of the iceberg.

As ever, we are enormously grateful to our friends within Oxford and outside. We are at an exciting time of great change, and your encouragement and support are vital to our success.

Sherlock Holmes and the case of the Oxford Mathematician

Professor Moriarty, a mathematical genius, is a tough opponent. He's smart, evil and relentless – a perfect match for Robert Downey Jr. and Jude Law in the new Sherlock Holmes movie (*A Game of Shadows*), released in December by Warner Bros.

Moriarty's formulas for world domination, as seen in the film, aren't the stuff of fantasy. They are the stuff of Prof. Alain Goriely and Dr Derek Moulton, from the Mathematical Institute, who helped Warner Bros. to give mathematical credibility to the movie.



According to Prof. Goriely:
Conan Doyle probably felt that equations didn't fit easily into his story. However, on the screen they're perfect – powerful, beautiful and mysterious. They tell us everything we need to know about the Professor. This guy is smart. Sherlock is in trouble and the clues are all on the board.

The Oxford pair's brief was to design the blackboard in Moriarty's office, a gigantic board filled with intricate, beautiful, yet mathematically exact, equations and formulas:
Unfortunately, Conan Doyle told us very little about Prof. Moriarty, and we had to do some sleuthing of our own. The challenges were multiple and complex. Our first task was to give Moriarty some intellectual and mathematical depth, consistent with the period from the hints and clues lightly sprinkled among the Sherlock Holmes stories. Then, we designed the code and cypher that Moriarty uses to carry his evil plots: This code is based on Moriarty's fascination with the binomial theorem, Pascal's triangle, and the Fibonacci p-codes. It is elaborate and reliable, as only Moriarty could have come up with.

Dr Moulton and Prof. Goriely also wrote an entire mathematical lecture that Moriarty gives around Europe. The lecture, entitled 'Singularity, collisions and blow-ups in the *N*-body problem', is based on Moriarty's second book *The Dynamics of an Asteroid* and was road-tested by Prof. Goriely at the Oxford Centre for Collaborative Applied Mathematics (OCCAM) a year ago behind closed doors:
Celestial mechanics was a hot topic by the end of the 19th century, and Moriarty could see the benefit of computing ballistic trajectories and collision events for his own Machiavellian plans. Do not be surprised if there are a lot of big guns in the movie. Mathematics has done so much good for mankind, but this was a reminder of what happens when it falls into the wrong hands. Without revealing too much, by the end it is the mathematics itself that defeats Moriarty!

Oxford Mathematical institutes through the ages

Nick Woodhouse and **Robin Wilson**

The earliest 'mathematical institute' in Oxford may have been the School of Geometry and Arithmetic, whose doorway can still be seen in the Schools Quadrangle of the Bodleian Library, built in 1600–20. Later, mathematical lectures were given in the Old Ashmolean (now the Museum for the History of Science).

In the 19th century, lectures were mainly given in colleges, prompting **Charles Dodgson** (Lewis Carroll) to write a whimsical letter to the Senior Censor of Christ Church. After commenting on the unwholesome nature of lobster sauce and the accompanying nightmares it can produce, he remarked:

This naturally brings me on to the subject of Mathematics, and of the accommodation provided by the University for carrying on the calculations necessary in that important branch of science.

He continued:

It may be sufficient for the present to enumerate the following requisites: others might be added as funds permitted.

A. *A very large room for calculating Greatest Common Measure. To this a small one might be attached for Least Common Multiple: this, however, might he dispensed with.*

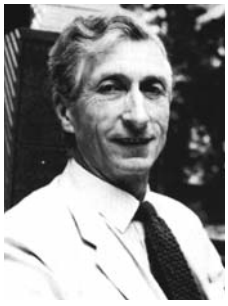
B. *A piece of open ground for keeping Roots and practising their extraction: it would be advisable to keep Square Roots by themselves, as their corners are apt to damage others.*

C. *A room for reducing Fractions to their Lowest Terms. This should be provided with a cellar for keeping the Lowest Terms when found, which might also be available to the general body of Undergraduates, for the purpose of 'keeping Terms.'*

D. *A large room, which might be darkened, and fitted up with a magic lantern, for the purpose of exhibiting Circulating Decimals in the act of circulation. This might also contain cupboards, fitted with glass doors, for keeping the various Scales of Notation.*

Charles Dodgson, Mathematical Lecturer at Christ Church, 1856-1881

G.H.Hardy FRS, Savilian Professor of Geometry, 1920-1931, at New College in 1930



Charles Coulson FRS, Rouse Ball Professor of Mathematics, 1952-1972, Professor of Theoretical Chemistry, 1972-1974, and Chairman of Oxfam

E. *A narrow strip of ground, railed off and carefully levelled, for investigating the properties of Asymptotes, and testing practically whether Parallel Lines meet or not: for this purpose it should reach, to use the expressive language of Euclid, 'ever so far.'*

This last process, of 'continually producing the Lines,' may require centuries or more: but such a period, though long in the life of an individual, is as nothing in the life of the University...

May I trust that you will give your immediate attention to this most important subject?

Believe me, Sincerely yours, MATHEMATICUS.

On 5 June 1930, **G. H. Hardy**, then Savilian Professor of Geometry in Oxford, wrote a short article for the *Oxford Magazine*. In his article he

- bemoaned the lack of attention to mathematics by the University;
- encouraged Oxford to build up a fine mathematical school, saying that 'mathematicians are reasonably cheap, but they cannot be had for nothing';
- urged an increase in the number of mathematical lecturers, and proposed an increase in research activity as essential for the future;
- argued strongly for the founding of an Institute where faculty members and graduate students could meet and lectures could be given: 'Why should a professor have to grovel before a College Bursar when he wants a room and a decent blackboard?'

At first, the response to Hardy's plea was modest. All that was granted for the new 'Institute' was a temporary foothold in the newly constructed extension to the Radcliffe Science Library in 1934; this consisted of a room for each of the four professors, one for a secretary, and one for lectures.

In the 1950s, Oxford's mathematical community expanded rapidly, following the arrival of the topologist Henry Whitehead as Waynflete Professor, and in 1953 the Institute moved into a Victorian house on the corner of Parks Road and Museum Road, later occupied by other University departments. Eventually, in 1966, a custom-made Mathematical Institute was built in St Giles, where it remains to this day.

The St Giles building had many advantages. Its detailed design was overseen by **Charles Coulson**, Rouse Ball Professor of Mathematics, who insisted that pure and applied mathematics should be under the same roof (unlike at Cambridge at the time), and who understood well the needs of his colleagues. In 1966, its large lecture theatres could easily hold an entire year-group, and provided acres of blackboard, enough for even the most enthusiastic of lecturers. Above all, it was close to the centre of Oxford, so that undergraduates could attend a lecture and cycle back to their colleges for tutorials in the following hour.

Space, however, rapidly became a problem. Funding constraints did not allow for a vision of future growth, and nor did they allow enough space to tempt tutors away from their college rooms. The building was barely large enough to house the professors, university lecturers, visitors and graduate students, and before long it was overflowing into a house in St Giles, and then into one floor after another of Dartington House, a utilitarian block in Little Clarendon Street, where OCIAM and the Centre for Mathematical Biology found their home. Eventually, other buildings were also needed.

It is now time to move again, and we have been fortunate to have the opportunity to do so. The University bought the site of the former Radcliffe Infirmary, which had become redundant as a hospital, and the Institute has again had the opportunity to design from scratch a purpose-built home for mathematics in the centre of Oxford. The new building will serve the whole mathematical community: professors, lecturers, and students at all levels. It will look outwards, and provide proper facilities for the many distinguished visitors who are drawn to Oxford and who contribute so much to our mathematical culture. ■

Above left and centre: St Giles, before and after the building of the Mathematical Institute

Above: Mathematical Institute at 10 Parks Road

Below: The new Mathematical Institute, in early 2012

Sir Michael Dummett (1925–2011)

John N. Crossley

We are sad to report the death of Sir Michael Dummett, Emeritus Wykeham Professor of Logic, at the age of 86. He was one of the most distinguished philosophers of his age and a profound thinker, straddling both philosophy and mathematics. For fifty years he contributed to the development of mathematical logic and philosophy across the Faculty of Mathematics and the Sub-faculty of Philosophy.

Gödel's work in the 1930s confirmed the complexity, rather than the monolithic nature, of mathematical truth, and throughout his life Michael was obsessed with truth in all its forms. He is particularly known for his work on Gottlob Frege, but he also entertained others' notions of mathematical truth – notably intuitionism, on which he wrote a definitive book. When he first lectured on intuitionism the logic was strange indeed, but it now forms the basis of much of the logic used in computer science.

In the 1960s he worked with mathematicians to build up the study of mathematical logic and this led to the creation of a lecturership, and ultimately a professorship, in the subject, supported jointly by the two faculties. In 1969, following his initial suggestion, the Oxford Joint Honour School in Mathematics and Philosophy was set up, and much of his 1970s teaching was for this new joint degree. He was guest of honour at the 40th anniversary celebrations in 2009 (see *Newsletters* 8 & 9).

Michael was also an expert on the mathematical theory of voting and on the Tarot –as a card game, not for fortune telling. In the wider society he will be remembered for the practical application of his philosophical mien in his determination to stamp out racial discrimination.

He brought mathematical expertise – self-taught – and profound philosophical thinking to all his endeavours, and inculcated tolerance and carefulness in his students and listeners. ■

Sir Michael Dummett

Appointments...

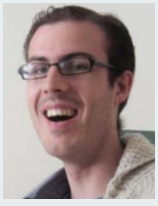
We are delighted to welcome the following new members of the Mathematical Institute.

Dmitry Belyaev (*Princeton*): University Lecturer in Analysis and Tutorial Fellow at St Anne's College. *Research interests*: interactions between complex analysis, probability, and statistical physics.

Helen Byrne (*Nottingham*): Professor of Computational Biology and Fellow of Keble College. *Research interests:* Multi-scale modelling of biological tissues.

David Conlon (*Cambridge*): University Lecturer in Discrete Mathematics, Royal Society University Research Fellow, and Tutorial Fellow at Wadham College. *Research interests*: extremal and probabilistic combinatorics.

Minhyong Kim (*UCL*): Professor of Number Theory and Fellow of Merton College. *Research interests*: arithmetical algebraic geometry.



Tom Sanders (*Cambridge*): Senior Research Fellow, Royal Society University Research Fellow, and Tutorial Fellow at St Hugh's College. *Research interests*: aspects of algebra, analysis, combinatorics, geometry and number theory.

'Retirements'

Sam Howison writes:
As governments grapple with pension deficits, 'retirement' has become a hazy concept. Academics have never taken it that seriously, regarding it more as an asymptotic state – after all, why should one stop being a mathematician on some arbitrarily specified date? Nevertheless, while the formal stage exists we mark it, and this year we see the 'retirement' of two very long-standing members of the department, **Hilary Priestley**, Professor of Mathematics and Fellow of St Anne's College, and **Nick Woodhouse**, Professor of Mathematics, Fellow of Wadham College and former Chairman of the Mathematical Institute, with 75 years of service between them.
Needless to say, both remain as academically active as ever within the Institute and beyond – in Nick's case, as Deputy Head of the Mathematical, Physical and Life Sciences Division. Retirement, indeed!

Achievements

It has been another excellent year for awards and appointments:

David Acheson, *Emeritus Fellow of Jesus College*, was President of the Mathematical Association for 2010–11.

Sir John Ball FRS, *Sedleian Professor of Natural Philosophy*, has been elected to the Executive Board of the International Council for Science.

Martin Bridson, *Whitehead Professor of Pure Mathematics*, gave the 2011 Erwin Schrödinger Lecture at the University of Vienna.

Gui-Qiang Chen, *Professor of Partial Differential Equations*, was awarded the 2011 SIAG/APDE prize by the Society for Industrial and Applied Mathematics for the best paper on PDEs published in the preceding four years.

Simon Donaldson FRS, *former Wallis Professor of Mathematics*, received a knighthood in the New Year Honours, 2012.

Marcus du Sautoy, *Simonyi Professor for the Public Understanding of Science*, has been appointed President of the Mathematical Association for 2012–13. He recently presented a three-part BBC TV series, *The Code*.

Dominic Joyce and his Oxford team have been awarded a £1.8M ESPRC grant to conduct research into fundamental algebraic and geometric structures underlying multi-dimensional phenomena.

Terry Lyons FRS, *Wallis Professor of Mathematics*, has been appointed Director of the Oxford-Man Institute of Quantitative Finance.

Bryce McLeod FRS, *Emeritus Fellow of Wadham College*, was awarded the 2011 Naylor Prize of the London Mathematical Society.

James Murray FRS, *Professor Emeritus of Mathematical Biology*, was awarded the 2011 Leonardo da Vinci Award of the European Academy of Sciences.

Peter Neumann gave the 2011 Enriques Lecture in the History and Philosophy of Science in Milan, and the British Society for the History of Mathematics – Gresham College Joint Lecture in London (*see www.gresham.ac.uk*).

Barbara Niethammer, *Professor of Applied Mathematics*, was awarded a Whitehead Prize by the London Mathematical Society.

Richard Norton (OxMoS) **and Kostas Zygalakis** (OCCAM) won prizes in the Leslie Fox Competition in Numerical Analysis.

Jonathan Pila, *Reader in Mathematical Logic*, received a Clay Research Award for his work on modular curves, and was awarded the Senior Whitehead Prize of the London Mathematical Society.

Raphaël Rouquier, *Waynflete Professor of Pure Mathematics*, has won a Royal Society Wolfson Research Merit Award for his work on higher categorical and homotopical methods in representation theory.

Rebecca Shipley (OCIAM) was awarded the Early Stage Investigator prize by the Tissue and Cell Engineering Society.

Jackie Stedall (Queen's College) has been elected Vice-Chair of the executive Committee of the International Commission for the History of Mathematics.

Sir Andrew Wiles FRS has taken up his position as Royal Society Research Professor at Oxford University.

Robin Wilson (Pembroke College) has been elected President of the British Society for the History of Mathematics.

And finally, the 15th Biennial Oxford / Cambridge Applied Maths Competition was won by Oxford; the **Woolly Owl Trophy** is now back with OCIAM.

Inspiring the next generation of mathematicians

Professor Frances Kirwan talks to Helen Carasso about her work in Oxford and with the UK Maths Trust

Frances Kirwan became a Fellow of the Royal Society in 2001 and served as President of the London Mathematical Society from 2003 to 2005. Although Professor Kirwan's research is devoted to the geometry of multi-dimensional objects, she prefers to frame the problems she tackles by first sketching their two-dimensional equivalents – an approach that she attributes to what she describes as her 'visual memory'. For more than 25 years at Oxford, the questions she's addressed have included some derived from the physicists' unresolved quest for the Grand Unified Theory, a mathematical context in which quantum mechanics and relativity can both be explained. Her work now lies closer to her initial interests, which developed when studying for her doctorate under the supervision of Prof. Sir Michael Atiyah in the early 1980s – combining geometrical ideas and intuitions with the principles of algebra.

Throughout her busy career, she has made time to share her enthusiasm for her subject with young mathematicians, initially during the 1990s through an outreach programme of Mathematical Masterclasses run by the Royal Institution. It was during this period that the UK Mathematics Trust (UKMT) was set up to coordinate the many mathematics competitions that had sprung up around the country.

Professor Kirwan's Oxford colleague Dr Peter Neumann, the founding Chairman of the Trust, soon suggested that she might like to become involved with its work. She declined then, partly because her own children were already taking part in its Challenges, though this meant that she could see at first hand how effective the Trust was in inspiring young people to enjoy mathematics. When she felt able to participate, she was therefore happy to take over as the Trust's third Chair in 2010, succeeding Prof. Bernard Silverman, former Master of St Peter's College.

Fifteen years after it was founded, the UKMT now involves more than 600,000 young people from over 4000 secondary schools in its events and competitions. This is achieved through a substantial group effort, using volunteers of all ages, from students to the retired, who provide huge amounts of energy, enthusiasm and time.

Photo by Rob Judges

Frances Kirwan

As well as its Challenges for teams and individuals, Olympiads, mentoring and summer schools, the Trust selects, trains and supports national teams for events such as the International Mathematical Olympiad, and runs seminars for maths teachers who are seeking new ways to engage and motivate pupils with different levels of ability and interest in the subject. A special new initiative is the European Girls' Maths Olympiad, which takes place for the first time in 2012.

As Chair, Frances Kirwan sees her priority as ensuring that the UKMT responds to the demand its success has created: *One of the next big tasks is to move the Trust from being a new institution to something that can continue going happily way into the future.* With that focus in mind the Trust looks set to continue to play an important part in developing new generations of mathematicians for many years to come (see *www.mathcomp.leeds.ac.uk*). ■

My Marvellous Mathemagicians

Marcus du Sautoy, *Simonyi Professor for the Public Understanding of Science*

Founded in 2009, *Marcus's Marvellous Mathemagicians* are ambassadors for mathematics who visit schools across the country to explain the beauty and the relevance of mathematics in an engaging way; they are recruited from the graduates and undergraduates studying mathematics in Oxford.

Our aim is to foster a greater understanding of, and engagement with, mathematics among students and the wider community, while also making it more entertaining. By enabling Oxford students to engage in many of my outreach activities, I hope to create the next generation of mathematics communicators.

Since the beginning of 2010, we've made many visits to schools across the UK to deliver activities that I've already road-tested in schools, as well as creating our own workshops for specialist audiences. We continue to be hugely popular, with demand far outstripping supply.

In addition to our school visits, we've been involved in other events and festivals, including: creating a maths installation at the Barbican's Radical Nature exhibition, teaming up with the Oxford Philomusica at the Oxford Science Festival to reveal the close relationships between Maths and Music, and holding workshops on the streets of Dublin for Irish Maths Week. Our most exciting project this year involves Mathematical Walking Tours of Oxford and the East End of London. Entitled 'Maths in the City', our tours highlight the fundamental role that maths plays in society by viewing the urban environment in a mathematical way (see *www.mathsinthecity.com*). ■

Institute Garden Parties

Last year's Mathematical Institute Garden Party was held at St Anne's, and was preceded by a lecture on *Indra's pearls* by Prof. Caroline Series.

This year's event will take place on **Sunday 8 July**, with lectures at 4 pm in the University Museum lecture theatre, followed by the Garden Party at St Anne's College. The lectures will be given by Prof. Alain Goriely on *The mathematical mind of Professor Moriarty: all the mathematics you didn't see in the movie* (see page 3) and Dr Derek Moulton on *Seashell growth and morphology*. There will also be an update on the new building.

Maths and cricket

Photo © Getty Images

Oxford Maths alumna Claire Taylor MBE retired from international cricket in July 2011. She played a key role with the bat in making England the top-ranked one-day side in the world and holds the record for the highest one-day score (156) by either sex at Lord's. When made a Wisden Cricketer of the Year in 2009, she said: *I don't know if other people do it, but when I'm batting at my best, I have a 3D awareness of the shape of the field and where the spaces are ... Maths, I think, has given me more control and confidence...* It's good to know that Mods Geometry has its uses.

Alan Tayler Lecture

The Alan Tayler Lecture is held annually at the end of Michaelmas Term and is sponsored by the Smith Institute. Alan was a Founding Fellow of St Catherine's College and a much-loved tutor, and the lectures, which reflect his interests in applied and industrial mathematics, attract many of his former pupils as well as mathematicians and scientists from around the UK.

The lecturers form a distinguished cohort from all over the world. Most have been applied mathematicians, but the theme throughout has been how maths is both exciting and useful. A list of lectures since 1986 can be found at *www2.maths.ox.ac.uk/ociam/seminars/atayler/history.shtml*.

The 2011 Alan Tayler lecture was given by John Ockendon. This was particularly poignant as John was Alan's first graduate student, as well as being a Fellow of St Catherine's which hosts the lecture. John has worked on industrial applications throughout his career, and his lecture, ranging from Pythagoras to Fermat's theorem, via waves and Bessel functions, illustrated his belief in the power of mathematics to provide understanding and insight.

Mathematical treasures

The Mathematical Institute was pleased to host an exclusive event in the Divinity School and Convocation House in November, highlighting some of Oxford's greatest mathematical treasures. Featuring a lecture by Dr Jacqueline Stedall (Senior Research Fellow in the History of Mathematics) and a display of several rare books and manuscripts, the event was extremely enjoyable, providing an excellent opportunity to strengthen relationships with a select group of friends and supporters.

History of Maths: new books

After many years researching Galois' writings in Paris, **Peter Neumann** has produced *The mathematical writings of Évariste Galois*, containing new transcriptions and English translations of, and extensive commentaries on, Galois' writings. It was published on 25 October 2011, the bicentenary of Galois' birth. **Jacqueline Stedall** has also recently written an important historical work, *From Cardano's great art to Lagrange's reflections: filling a gap in the history of algebra.* Both of these books are published by the European Mathematical Society (see *www.ems.ph.org*).

On a more popular level, **Raymond Flood** and **Robin Wilson** have produced an illustrated coffee-table book, *The great mathematicians* (Arcturus), featuring over 100 mathematicians from the past. Several of these were, of course, Oxford mathematicians.

Orthogonal sudoku

Fill in the empty cells in the puzzle below, so that each cell contains one of the numbers 1, 2, . . . , 9 and one of the letters a, b, . . . , g. Each number and each letter must appear exactly once in each row, column and 3×3 block, and each of the 81 possible number–letter pairs must appear somewhere in the grid. (The numbers and letters are said to form a pair of orthogonal Latin squares.)

1 a		3		b	8	c	2 d	
	5			2 e	c			3
7		9		4	3 f			
			9 b		5 g			
h	8 d	5		3 i		b	c	g
2	b	6 c	4 h		7 a		8	
c				h				
8 f			5	g	2		a	
	9			f				

***Solution to last year's puzzle*:**
COUNTABLE (row 5 backwards)