University of BRISTOL

mathsgrad 2008
news for maths alumni

New maths building at centre of science

Proposed concept for the new maths building

A new £34-million mathematics building will put maths – quite literally – at the very heart of the University's science teaching and research.

The construction of the new maths building is just one of a number of building projects within the Faculty of Science, including a major refurbishment of the physics building, a new biological sciences complex and the new nanoscience/quantum information building. The maths building will be at the centre of this 'science cluster', reflecting the growing centrality of maths to these disciplines.

The proposed maths building will be circular, looking outward to the other science subjects. Architect Jason Speechly-Dick of Sheppard-Robson described the guiding principles behind the design of the building: 'The world of mathematics to me resides in the heads of mathematicians. I'm an architect who deals with the physical world. It seemed a logical reference to utilise the imagery of Charles Babbage's difference engine of 1822, a machine that successfully interfaces the real world with the ethereal. Its stacked, circular, cog-like elements inspired a circular building plan form, which informs and enhances the teaching process. Segments of floor plate are removed as we rotate upwards through the building, allowing daylight to enter into the central atrium.'

It is hoped that the new building will be ready in early 2011.

Bristol's Department of Mathematics was rated third in the UK in the 2007 *Times Online Good University Guide*. It was the only university in the UK to get a 5*A rating for statistics.

Welcome

In these pages you will see items about research and honours. You will also see news of a different nature that illustrates the inherently people-oriented and outward-looking nature of mathematics today.

The image of a mathematician in solitary contemplation of a problem is one that many people carry. But there is another, equally important, side of mathematics at Bristol. It is an unusual, and wonderful, time for mathematics, with more opportunities and progress than at any other time in history. The impact of mathematics on people's daily lives is now enormous and the department manifests this though its outreach programmes, as well as involvement in such areas as government and security.

It is fortuitous timing that maths is soon to be housed in a purpose-built building at the centre of the University. It will enhance the way we work and provide even more opportunities for the department to make an impact, both locally and internationally.

Professor Steve Wiggins
Head of Mathematics

Inside

Maths melting pot

Research and teaching are international endeavours and over the past few years the department has come to embody this internationalism. It now boasts staff from Australia, Belgium, Chile, Denmark, France, Germany, Hungary, India, Ireland, Israel, Italy, Japan, Netherlands, Poland, Portugal, Russia, Ukraine, UK, US and Vietnam. More than 60 per cent of the permanent academic staff originate from outside the UK. The quality of staff joining the department in recent years has been incredibly high. Professor Steve Wiggins said: 'This diversity of talent and training fosters a unique outward-looking department that connects with the mathematics community worldwide.'

Student travel award

Student Michael Wemyss (PhD Mathematics 2004-) has been awarded the 2007 Cecil King Travel Scholarship to spend three months in Nagoya University Japan investigating non-commutative resolutions in algebraic geometry and their links with cluster tilting.

Mathematicians defy gravity

Droplets of liquid have been shown to travel uphill, rather than sliding down as expected, when the surface they are on is vigorously shaken up and down. You can watch a video of a droplet moving uphill at www.bristol.ac.uk/news/2007/5630.html.

ISTOCK

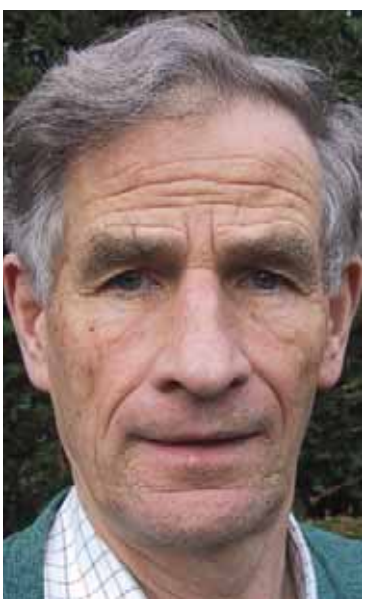
Inspiring future mathematicians

Bristol maths students are gaining invaluable hands-on experience of teaching through a scheme that encourages undergraduates to work in local schools. Dr Nina Snaith introduced the Undergraduate Ambassadors Scheme, a national initiative, to the department in 2005. Since then, the scheme has grown year on year. By 2007, 24 undergraduates had applied for the 12 places on offer.

The feedback has been extremely positive: school children have been inspired by the undergraduates' enthusiasm for maths; teachers have found the extra help beneficial; and undergraduates have learned how to communicate maths at the same time as gaining credits towards their degree. Many of the undergraduates who have taken part in the scheme are considering studying for a PGCE.

Remembering Peregrine

Professor D H Peregrine, Emeritus Professor of Applied Mathematics, died last year after a short battle against cancer. Howell had been with the University since 1964 and during this time built an immense international reputation in the field of fluid mechanics. Howell was an enthusiastic lecturer, and greatly enjoyed supervising undergraduate projects, MSc and PhD theses. He was also the mentor to many postdoctoral researchers, helping them find their way to variety of senior academic and industrial positions.



A parliamentary posting

The Parliamentary Office of Science and Technology (POST) is the UK Parliament's in-house source of independent analysis of public policy issues related to science and technology. Each year research councils sponsor PhD students to undertake three-month fellowships at POST. Last year Teil Howard (PhD Mathematics 2004-) was chosen as the Engineering and Physical Sciences Research Council fellow.

I have always been interested in politics and government and I saw the three-month fellowship as a great opportunity to gain an insight into how science is represented in Parliament. It was also a chance to find out about non-academic careers available in science and get some transferable skills.

POST's main output is briefing notes on topical subjects, known as POSTnotes. These are sent to parliamentarians but are also available to the public on the POST website. My task at POST was to write a POSTnote about smart materials and systems. These are materials or systems that can sense and respond to environmental changes. For example, the photochromic materials used in spectacle lenses become darker in response to increased light. As a mathematician, materials science is obviously very far removed from what I would normally be working on but it was really interesting to be able to learn about something completely new. My research involved interviewing interested parties such as government officials, leading academics and industry representatives. Writing the note was a delicate task, requiring many opposing views to be balanced accurately.

Working in Parliament was great fun. As a member of staff I was able to attend debates in both Houses, explore the labyrinthine corridors of the palace and drink on the terrace at the House of Lords bar. I saw the Queen arrive with her entourage for the state opening of Parliament and witnessed at first-hand the taunts of Prime Minister's Questions.

in brief

CLIFF COCKS AWARDED HONORARY DEGREE

Dr Cliff Cocks CB, Chief Mathematician, GCHQ (Government Communications Headquarters) and co-discoverer of foundational techniques in cryptography, was awarded an Honorary Bristol degree in February.

REUNION WEEKEND 2008

If you're coming to the Convocation Reunion Weekend, don't miss the chance to visit the maths department. The departmental visit will take place from 3 pm to 4.30 pm on 5 July.

LATITUDE LINE UP

Maths student David Smith (BSc 2003, PhD 2004-) and his fellow team members have been awarded the first Royal Geographic Society-IBG Land Rover 'Go Beyond' Bursary of £10,000. The team aims to circumnavigate the world along the line of 50° north.

STAFF PRIZE ROUND-UP

Professor Brian Conrey has been awarded the 2008 AMS Levi L Conant Prize. Professor Andreas Winter has won a Royal Society Wolfson Research Merit Award. Professor Hannes Leitgeb has been awarded a Philip Leverhulme Prize for his contributions to mathematical philosophy. Professor Trevor Wooley has been elected as a fellow of the Royal Society. Professor Sir John Kingman FRS has been elected to the US National Academy of Science. Professor John McNamara has won the International Society for Behavioral Ecology 2008 Hamilton Award.

research highlight: **fluid coating**

Researchers at Bristol have overturned a 60-year-old equation and discovered a new way of varying the thickness of fluid film coatings. Andrew Charlesworth reports.

Eureka! Jump out of the bath fast enough and a fair proportion of the water will do the same with you.

While that's to be expected of a complex shape like the human form, even a flat vertical plate raised from a bath of fluid will be accompanied by some of the fluid in the form of a thin film, stretched over the surface of the plate. This property is the basis of many industrial and manufacturing processes for dip-coating.

For any given viscosity of fluid, the thickness of the film deposited on the plate is largely governed by the speed at which the plate is withdrawn from the bath. Generally, the faster the plate travels, the thicker the film. In other words, the thickness of the film is proportional to the two-thirds power of the velocity with which the plate is withdrawn from the fluid bath.

However, through a series of theoretical calculations, Professor Jens Eggers and Jacco Snoeijer of Bristol have found conditions under which the thickness of the film is proportional to the half power of velocity and which can be used to produce a thicker film. Their calculations predict that the transition (where the liquid from the bath is stretched over the receding plate) occurs due to the appearance of a solitary wave.

Researchers at l'Ecole Supérieure de Physique et de Chimie Industrielles in Paris have conducted physical experiments which partially confirm the theory, and are currently conducting further tests to prove it in more detail.

Snoeijer and Eggers were able to observe the phenomenon by placing a thin wire parallel to the plate a few millimetres from the liquid film. The mirror image of the wire, reflected in the plate, is distorted by refraction, so they could reconstruct the wave by integration. The deposition of the film can be observed in three zones where different forces are dominant. In zone 1 gravity and viscosity are the dominant forces; in zone 2 viscosity and surface tension; and in zone 3 gravity and surface tension.

They discovered that the thickness of the film is dependent on the hydrophobic or hydrophilic properties of the fluid and plate surface. When the plate is at rest, the meniscus of a conventional hydrophilic liquid/plate combination creates an angle (theta 1) whereas that of a hydrophobic combination creates the angle (theta 2). When the plate is withdrawn from the fluid bath, the value of this angle affects the formation of the capillary ridge and hence the thickness of the film deposited under certain velocities of withdrawal. This means that within certain limits of velocity, the thickness of the film can be increased by first treating the surface with a substance which makes the desired coating act in a hydrophobic way.

Read more research highlights at www.maths.bris.ac.uk/research/highlights.