



Department of Chemical Engineering and Biotechnology Graduate Studies



UNIVERSITY OF
CAMBRIDGE

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Welcome to the University of Cambridge **Department of Chemical Engineering and Biotechnology**

Chemical engineering and biotechnology have key roles to play in global issues such as the environment, sustainability and healthcare.

Our aim is to produce the academic, industrial and entrepreneurial leaders of tomorrow, to drive the development of industrial processes and to create advances in chemical engineering and biotechnology. We are committed to working at the interfaces of the underpinning science disciplines of engineering, chemistry, biology and physics. We create a unique multidisciplinary research environment where collaborations within the University and with external academic and industrial organisations can flourish.

The diversity in our department is a strength that facilitates the sharing of ideas and attracts international collaboration as we seek innovative solutions to global challenges in improving the quality of life and the environment.

We conduct world-leading activities of critical mass including sustainable reaction engineering, product design and healthcare, fusing leading-edge biotechnology research with chemical engineering skills within an ethos of commercial awareness and exploitation to develop new research at the science-engineering interface in physics, chemistry and materials science.

We encourage exceptional and highly motivated graduates from all corners of the world to consider our range of engaging and stimulating study opportunities. Our innovative research, underpinned by a dynamic enterprise culture, spans the wide range of disciplines embodied by modern chemical engineering and biotechnology. Our commitment is to apply research for the benefit of society. We would like you to be part of our success in achieving this.



Professor Nigel Slater
Head of Department



Why study at CEB?

It is an exciting time to develop a career in chemical engineering and biotechnology and to apply your knowledge and skills to address the global problems faced by society today. Graduate study may lead to careers in areas as diverse as the control of carbon dioxide emissions to the development of new devices which seek to mimic biological organs and, as with many of our alumni, to leadership roles in academia and business across the globe.

The department offers a unique environment in which to undertake postgraduate study. Students join a vibrant research community staffed by world-leading interdisciplinary research scientists, many of whom have strong business skills as well as a keen interest in the education of the next generation of researchers and innovators. CEB is a relatively large department spread over three sites since the merger with the Institute of Biotechnology in 2008. It is comprised of some 50 postdoctoral researchers and close to 200 postgraduates. Individuals of almost 50 different nationalities bring a global perspective and diverse expertise, thus contributing to our world-class research output and reputation for academic excellence. Students enjoy close interactions with staff and fellow students and within and between research groups.

Research within the department is focused on five main themes: Biotechnology, Measurement, Microstructure

Engineering, Modelling and Processes (specific research areas are listed on page 6). In the 2008 UK Research Assessment Exercise, 85% of the department's research activity was rated as internationally excellent, placing CEB as the top ranked department in the country. Academic research undertaken here typically involves collaboration with other leading international universities and strong connections with industry. Research costs are supported in part by the RCUK - Government Research Councils and by a variety of industrial partners and multinational companies that invest in shared research interests and the application of emerging technologies.

The department is widely acknowledged for its entrepreneurial achievements and the successful integration of multidisciplinary research, commercial exploitation and management training. CEB spin-off companies have brought a range of patented products to market, including a functional food, next generation glucose sensors, novel therapies for the treatment of cancer and the diagnosis of disease as well as recycling and environmental technology solutions. Some of these achievements were recognised by The Queen's

Anniversary Prize for Higher and Further Education to the Institute of Biotechnology in 2007 and highlight our dedication in providing leading research facilities and investing in people.



Study options

Students are invited to apply for any research or taught postgraduate degree programmes at CEB. We offer three-year research-based programmes leading to the award of PhD in Chemical Engineering or Biotechnology. The MPhil in Chemical Engineering and Biotechnology is a one-year research-based course which, upon successful completion, may count towards the entry requirements for a PhD programme.

For those choosing a taught degree course, we offer two Master's degrees: the MPhil in Advanced Chemical Engineering (ACE), which includes a research component, and the MPhil in Bioscience Enterprise (MBE). Both are professional practice courses that provide training in science and technology as well as business and management.

The table below provides a brief description of the courses available. Please note that all our courses are full-time, and a fluent command of the English language is required. For additional requirements please refer to the University Graduate Prospectus: www.admin.cam.ac.uk/univ/gsprospectus/applying/entry.html

Degree options	Description	Entry requirements	Duration
Research studies	MPhil Chemical Engineering and Biotechnology Conduct fundamental and/or applied research in chemical engineering, chemical or biological science specialising in one of our declared research themes of Biotechnology, Measurement, Microstructure Engineering, Modelling and Processes. www.ceb.cam.ac.uk/mphilres	A 1st class or high 2.1 honours degree in a relevant subject. Chemical engineering, biological, physical or life science backgrounds are encouraged.	October – August
	PhD Chemical Engineering or Biotechnology Conduct fundamental and/or applied research in chemical engineering, chemical or biological science spanning across our declared research themes of Biotechnology, Measurement, Microstructure Engineering, Modelling and Processes. www.ceb.cam.ac.uk/phd	A 1st class or high 2.1 honours first degree or equivalent in a relevant subject. Chemical engineering, biological, physical or life science backgrounds are encouraged.	Three years Start in October, January or April
Taught courses	MPhil Advanced Chemical Engineering (ACE) Advanced Chemical Engineering with essential aspects of business administration. A five-month research project (not a taught element) complements the programme. www.ceb.cam.ac.uk/mphil	A 1st class or high 2.1 honours degree in Chemical Engineering or close equivalent.	October - August
	MPhil Bioscience Enterprise (MBE) Biotechnology and business professional practice course. Teaching covers the latest advances in biological and medical science, together with business management and the ethical, legal and regulatory issues associated with bringing scientific advances to market. www.ceb.cam.ac.uk/mbe	Excellent first degree in life or physical sciences, medicine, law, economics or allied disciplines.	October - June

Please note that this information was correct at the time of publishing. However, course details and entry requirements may change every year. Therefore, you are advised to check the Board of Graduate Studies website regularly for more updated information: www.admin.cam.ac.uk/offices/gradstud/prospec/studying/qualifdir/index.html



Research activities

Departmental research activities reflect the interdisciplinary nature of modern chemical engineering and biotechnology. Research is organised into the following themes that cover our contribution to grand challenges in the arena of chemical engineering and biotechnology:

	Biotechnology	Measurement	
Microstructure Engineering		Modelling	Processes

Listed below are our research activities and the Principal Investigators who lead these research groups and laboratories:

- Analytical Biotechnology - Prof Chris Lowe, Prof Lisa Hall
- Biochemical Engineering - Prof Howard Chase
- Bioscience Engineering - Prof Nigel Slater - in Cambridge Unit for Bioscience Engineering (CUBE) and Cambridge Unit for Responsive Biopolymers (CURB)
- Catalysis and Magnetic Resonance - Prof Lynn Gladden, Dr Mick Mantle, Dr Andy Sederman, Dr James McGregor, Dr Patrick Barrie - in the Magnetic Resonance Research Centre (MRRRC), the EPSRC National Centre for Nuclear Magnetic Resonance Imaging
- Cell and Organism Engineering - Dr Alan Tunnacliffe
- Colloidal Dispersions - Dr Alex Routh
- Combustion - Dr John Dennis
- Computational Modelling (CoMo) - Prof Markus Kraft
- Electrochemical and Micro Engineering - Dr Adrian Fisher - in the Centre for Research in Electrochemical Science and Technology (CREST)
- Fluids and Environment - Dr Silvana Cardoso
- Healthcare Biotechnology - Prof Chris Lowe - in the Institute of Biotechnology
- Laser Analytics - Dr Clemens Kaminski
- Neuro-psychiatric Research - Dr Sabine Bahn - in the Cambridge Centre for Neuro-Psychiatric Research (CCNR)
- Powder, Paste and Food Processing - Dr Ian Wilson, Dr Sarah Rough, Dr David Scott
- Polymer Fluids - Prof Malcolm Mackley
- Process Systems Engineering - Dr Vassilios Vassiliadis
- Structured Materials - Dr Geoff Moggridge
- Terahertz Applications Group (TAG) - Prof Lynn Gladden, Dr Axel Zeitler



For more information please go to: www.ceb.cam.ac.uk/research



'On a professional level, it's exciting to be a part of a department and university with a reputation for excellence in research. On a personal level, the close-knit community atmosphere here makes the department feel like a home away from home.'

Samantha Gooneratne, PhD student

Research events

Students enrolled on either research or taught programmes are invited to attend the department's science seminar programme. As students progress they are given training in preparing for practice in delivering poster and audiovisual presentations. Towards the end of their studies, the annual Postgraduate Conference provides later stage PhD students with a formal forum to present their findings to department colleagues, as well as visiting academics and industrialists.

Students are encouraged to broaden their expertise by participation in a selection of options from the wide range of transferable skills development courses offered in the department and centrally by the University. Examples of these include information technology, project and time management training, communication skills and intellectual property awareness.



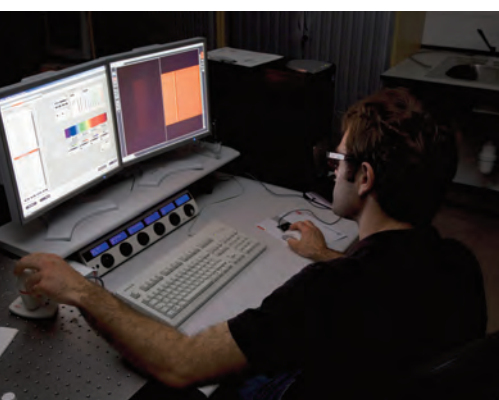
'John's enthusiasm for his work has inspired many students who have gone on to hold prominent positions in industry and academia. He has made significant contributions to the Pruteen biofermentation reactors - and is seen very much as the father of their subject.'

*Professor Lynn Gladden,
Pro-Vice-Chancellor for Research*

Emeritus Shell Professor of Chemical Engineering at CEB, John Davidson FEng FRS was recently awarded the Prince Philip Medal for his major contributions to chemical engineering on a global scale.

'Well balanced course, great people and fantastic environment.'

Kyung Min Song, MPhil ACE student



Course Overview

This unparalleled one-year, full-time, taught Master's programme is for those seeking the advanced skills required by companies in which rapid change and interdisciplinary working is now standard practice. The MPhil ACE starts in the autumn of each year. The course is unique because:

- Candidates receive an education both in advanced aspects of Chemical Engineering and in essential areas of business administration, such as technology policy, company formation, finance and management, global economics and sustainable development;
- There is a management consultancy project for a UK client organisation, designed to develop professional problem-solving skills; and
- It offers conventional research experience at a leading academic institution.

Content

Students combine advanced chemical engineering studies with essential aspects of business administration. A wide range of science-based elective courses is also available. A five-month research project complements the programme.

Michaelmas and Lent Terms

Students take two advanced chemical engineering modules, the Management of Technology and Innovation module (run by the Judge Business School), two core chemical engineering modules, and five engineering/ business elective modules. The taught material

enhances basic knowledge on chemical engineering fundamentals, as well as offering experience of other science and business based disciplines. The modules are assessed by both examination and written coursework.

March – August

During this period, students undertake a full-time research project within the department. The research may include industrial collaboration. The project is assessed by seminar and dissertation.

Programme Objectives

The programme sets ambitious educational objectives for its students, including the development of:

- An advanced understanding of fundamental areas of chemical engineering;
- An understanding of essential areas of business administration, e.g. finance and management, technology policy, company formation and structure, global economics and sustainable development;
- Professional consultancy skills, including time management, teamwork and leadership abilities, whilst interacting with company personnel in order to obtain information effectively and define optimal outcomes for the client; and
- The ability to define, organise and undertake a research project, with possible extensive industrial collaboration, within a specified period of time and to present it as a dissertation and seminar.

Compulsory Modules

Numerical Methods
Molecular Aspects
Management of Technology and Innovation

Core Chemical Engineering

Rheology and Processing
Electrochemical Engineering
Colloid Science
Biopharmaceuticals
Particle Technology
Catalysis
Modern Metrology
Optimisation

and Business Modules

Technological Innovation
Nuclear Power Engineering
Project Management
Enterprise and Business Development
Sustainable Water Engineering
Strategic Management
International Business Economics
Sustainable Energy

Please note the modules may change from year to year.

Teaching and Learning Methods

Students participate in lectures, small group teaching (supervisions), tutor-led seminars and demonstrations, consultancy projects, case studies and research projects.

Assessment

The assessment of taught modules involves a combination of some or all of the following:

- Coursework – individual or group
- Class participation
- Written examination

• Presentations – individual or group
To gain the MPhil degree, students are expected to pass satisfactorily both main elements of the course, namely:

- Formal taught modules
- Research project

Entry Requirements

The MPhil cohort is made up primarily of students with a good first class honours degree in Chemical Engineering. The extent of the course requires students who are very highly motivated, innovative, able to work efficiently both on their own and in a team and who have high levels of perseverance. Applicants need to demonstrate a high level of commitment and diligence, irrespective of formal academic qualifications, when they apply.

The MPhil course has managed to combine chemical engineering with business skills very effectively; exactly what I was hoping to achieve from my time at Cambridge.'

Brendan Wilmot BSc

For further information contact:

Dr Sarah Rough
MPhil ACE Programme Manager
slr1002@cam.ac.uk
www.ceb.cam.ac.uk/mphil



MPhil Bioscience Enterprise (MBE)

'I have thoroughly enjoyed my Cambridge experience in the past year. The MBE programme provided me with discipline-specific knowledge, transferable business and management skills and a comprehensive understanding of the global healthcare industry. The professional network I developed through this programme will continue to benefit my career pursuits in the future.'

Celine Zeng, MBE student



Course Overview

The MPhil in Bioscience Enterprise (MBE) programme is a taught science, technology and business course intended for those who have the ambition to found technology companies or take up leadership, executive, or consultancy roles in the life science sector.

All students follow the same syllabus during the first two terms of this intensive nine-month professional-practice programme. Teaching covers the commercial exploitation of the latest advances in biotechnology together with the business and management skills associated with bringing scientific opportunities to market. There is a particular emphasis on understanding how companies are created, funded, and developed. Learning is based on real business scenarios, and lectures and case studies are frequently delivered by senior company executives.

Science syllabus: Small molecule and biopharmaceutical drug development; medical devices, diagnostics; agri-biotech.

Business syllabus: Product and company valuation; partnerships and alliances; healthcare economics; accounting and finance; regulatory affairs; technology and innovation management; marketing; strategy; intellectual property and corporate law.

Students have numerous opportunities to apply their skills and the principles learned, for example, when working in teams on a consulting project and in developing a plan for a concept company. During the third term students are engaged on an internship with a life science company where they are responsible for a defined business project and collect data and analyse it as the basis for a dissertation.



The MBE course offers participants an unparalleled educational experience in both the department and the neighbouring Judge Business School, with access to leading scientists, entrepreneurs, and academics and the life science business network. The department is unique in its practical and successful approach to bio-entrepreneurship and is widely acclaimed for the excellence of its science and business graduates.

International Perspective

Students gain an international perspective of the industry during a faculty-led study tour to the Boston, MA, USA life science cluster. In addition, class members usually organise an optional study visit to another destination, including in recent years Switzerland, China, and Sweden. Please note that additional charges are made for travel and other expenses associated with the programme.

Assessment

Whilst there are no formal examinations, attainment is assessed throughout the course with emphasis on learning through problem-solving and teamwork in the

research, preparation and delivery of presentations and project work. Written submissions include science and technology papers, various short reports and critical appraisals, a client briefing paper and a dissertation. Students are encouraged to participate in extracurricular enterprise activities including regional and national business competitions and are required to submit a business plan as one of the course assignments.

Entry Requirements

Applicants must hold an excellent first degree in the biological, medical, or physical sciences or have experience in the financial or legal sectors. A strong interest in pursuing a business career in the life sciences, and a fluent command of English are essential. A higher degree or postgraduate experience in an academic or business environment is highly advantageous.

For further information please visit the website or contact the course administrator:

Tel: +44 (0)1223 766337

Email: biosci@biotech.cam.ac.uk

Website: www.ceb.cam.ac.uk/mbe



Graduate Student Experiences

Edward C. White, Jr. Chemical Engineering PhD



I joined the Computational Modelling Group this year after completing the Certificate of Advanced Study in Mathematics at Cambridge in 2008-2009. I am partly funded by the

Cambridge Overseas Trusts and by Hughes Hall. Prior to coming to Cambridge, I worked in finance and investments in New York City for thirty years. In addition to a BA degree in economics, I hold an MS degree in quantitative analysis (statistics and optimization), and an MS degree in mathematics.

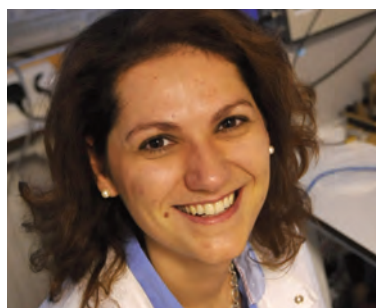
Currently, I am working on integrated computational models that combine the analysis of combustion chemistry with the analysis of soot particle dynamics. Such models are useful in the search for new fuels and in the quest to achieve cleaner, more fuel efficient internal combustion engine designs.

I have a strong interest in mathematics, computational science and their applications.

As I began to consider PhD study, I knew that I wanted to work on challenging industrial problems involving mathematical and numerical methods in a group setting that fosters cooperation and teamwork. I was able to find both in the Computational Modelling Group within the Department of Chemical Engineering and Biotechnology.

The best aspect of my research is its highly interdisciplinary nature. The modelling of combustion and particle processes involves chemistry, physics, engineering, mathematics, statistics and computing, generally at a very high level. It is fascinating to see these very different fields brought together to solve problems.

Ria Koupritzi Biotechnology PhD



After receiving my BSc (Hons) in physics from the Aristotle University of Thessaloniki, Greece, and during my Master's course in nanotechnology at the Universities of Leeds and Sheffield, I

started developing an interest in biology.

In order to pursue doctoral studies, I mainly started looking at the websites of different universities and research groups in the UK to see what opportunities they offered on applications combining biology and physics. I was especially intrigued by the plethora of groups working on research areas that bring together physics, biology, chemistry and biochemistry so uniquely here at the University of Cambridge.

Professor Chris Lowe's research group offered me a fully funded Royal Society of Chemistry (RSC)/Engineering and Physical Sciences Research Council (EPSRC) PhD studentship to explore potential applications of a newly developed in-house technology. The project involved testing bio-molecular interactions on the Magnetic Acoustic Resonator Sensor (MARS). Without a second thought, I grabbed the opportunity to work on a unique project in one of the best universities in the world situated in one of the most beautiful cities in the UK.

From my personal experience, the structure of the University and the resources available and the collaboration among departments and research groups provide the ideal setting for anyone pursuing postgraduate studies here.

Wilson Yeung

MPhil Advanced Chemical Engineering (ACE)



I am a Chinese student born in Hong Kong but raised and educated in the UK since the age of four. Having completed my undergraduate studies in Chemical Engineering at the University College

London, I enrolled on the MPhil Advanced Chemical Engineering at Cambridge University as a self-funded student.

The department provides the highest quality of teaching, and the academic staff are very passionate and excel in their respective subjects. Being part of a small group of talented, disciplined, funny and culturally diverse MPhil students makes the department an even more enjoyable environment.

The MPhil ACE is truly unrivalled. Not only do the core modules offer useful further technical knowledge in the field of chemical engineering, but the business and management electives taught at the Judge Business School also add another dimension to the programme.

Since joining the department in October 2009, I have completed a rather intellectually stimulating module in numerical methods. At present, I look forward to choosing my research topic for the summer before starting the Management of Technology and Innovation Programme consulting project in Lent Term.

Jenny Versnel

MPhil Bioscience Enterprise (MBE)



I was born in Cambridge, but the majority of my education took place in South Africa where I trained in Genetics and Microbiology. Following my first postgraduate degree, I worked for several

years on MRC funded research projects latterly focusing on rejection factors associated with organ transplantation. On returning to the UK, I moved to the charitable sector and before joining the MBE programme was Executive Director of Research and Policy at Asthma UK. There I was responsible for their £3 million research programme and its strategic development, health policy and influencing work at Westminster and in Brussels.

Being entrepreneurial by nature, I identified potential commercial opportunities, but I realised that I lacked the business skills required to bring these to fruition. Whilst initially believing the solution was an MBA, I soon recognised that what I wanted was a course more focused on innovation and entrepreneurship in the field of science. The Cambridge MPhil in Bioscience Enterprise programme aligned with my aspirations, and my ambition is to put this learning into practice and bring at least one of my ideas to market.

For me, the most stimulating lectures are those where I am learning first hand from entrepreneurs, but I also appreciate the breadth of topics covered in the course and diverse opportunities to hear from people across the industry. The varied educational and cultural backgrounds of my colleagues provide stimulating perspectives for group work and opportunities to combine skills to explore new business opportunities.



How to apply

In order to study for a graduate course in chemical Engineering or biotechnology at the University of Cambridge you must formally apply to the Board of Graduate Studies. More information about the application process is available from the Board of Graduate Studies website: www.admin.cam.ac.uk/offices/gradstud

The Colleges

Graduate students at Cambridge are not only members of the University but also members of a college. The collegiate system of the University creates an environment in which you will meet people from other disciplines and participate in a wide variety of cultural, sporting and social activities.

Colleges provide accommodation, meals and other amenities. Facilities vary but typically include student common rooms, libraries, laundry and computing facilities. Sports facilities such as rowing, rugby, football, cricket, athletics, squash, tennis and badminton are usually available at little or no cost.

Each student is assigned a graduate tutor who is responsible for their welfare and in addition supports all manner of graduate activities and interactions between students and college fellows.

Funding

Typical costs for full-time study, including university and college fees and maintenance (living costs), are given in the Graduate Studies Prospectus at: www.admin.cam.ac.uk/offices/gradstud/fees/funding/

While the department does not provide student funding, home and EU students may be eligible for UK research council studentships. Overseas students may be eligible for funding from the Gates Cambridge Trust, the Cambridge Commonwealth and Overseas Trusts and other charitable organisations. Students may also support their study through loans, personal savings or family contributions. For more information see: www.ceb.cam.ac.uk/funding

Scholarships are highly competitive and the deadlines for applications can be a year in advance of the proposed start date of your course, particularly for overseas students. More information can be found at: www.cam.ac.uk/admissions/funding

Please note that there are very few funding opportunities open to students who have already started their course. However, colleges may invite their graduates to apply for funds for travel, conferences, research abroad, childcare or computing expenses and in cases of hardship. Please check individual college websites for detailed information.

Careers

Last year over 95% of Cambridge graduates gained employment or went onto further study. The University Careers Service provides resources information about vacancies and arranges specialist workshops and events. For more information see: www.careers.cam.ac.uk

Equality and Diversity

The University of Cambridge is fully committed to equality of opportunity, promotes an inclusive culture and values diversity. Talented applicants from any country and of any race, religion or group are encouraged to apply. Admission is determined only by performance and personal merit.

Student Welfare

Advice and support for students and their dependants in Cambridge are available through the Graduate Union and University Counselling Service.

University of Cambridge and Environs

Cambridge is a great place to be a student. If you have an image of Cambridge, it is probably one of ancient buildings, immaculate green lawns and people punting down a willow-fringed river. This is an accurate image - the city is stunningly beautiful - but there is a lot more to it than that.

Cambridge is a fascinating mix, but it is small enough to retain its community atmosphere. A town of bustling streets, theatres, cinemas, cafes and restaurants, it also

has a thriving central market and a good range of shops. Green spaces and parks with cows grazing on the meadows are a feature of the city.

When you want to escape, the countryside is very close with pleasant walking and cycle routes from the city centre to villages such as Coton and Madingley. Further afield, visit Ely to see the magnificent cathedral and absorb the unique and mysterious atmosphere of the Fens.

Cambridge has good road and rail connections to the rest of the UK, and London is only 50 minutes away by train. The city is also within easy reach of all London's international airports, and there is a direct 30 minute rail link to London Stansted Airport.

Information about the city and cultural events is available on the official tourism website: www.visitcambridge.org

For the student perspective about studying in Cambridge visit the Graduate Union website: www.gradunion.cam.ac.uk





Department of Chemical Engineering and Biotechnology

New Museums Site

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Fax: +44 (0)1223 334796

Institute of Biotechnology

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Cambridge CB2 1QT

Tel: +44 (0)1223 334160
Fax: +44 (0)1223 334162

Magnetic Resonance Research Centre

J J Thomson Avenue
Cambridge CB3 0HE

Tel: +44 (0)1223 334777
Fax: +44 (0)1223 334796

For further information please visit: www.ceb.cam.ac.uk or contact us at: emailus@ceb.cam.ac.uk