global grand challenges summit

Exploring collaborative approaches to tackling global grand challenges

LDN
12-13 MAR
2013

Programme

LONDON, 12-13 MARCH 2013

ROYAL ACADEMY OF ENGINEERING

NATIONAL ACADEMY OF ENGINEERING
FOUNDED 1964

NAE GRAND CHALLENGES FOR ENGINEERING

CAE

global grand challenges summit

DATE: 12-13 MARCH 2013
VENUE: IET LONDON: 2 SAVOY PLACE, LONDON WC2R 0BL

LOCKHEED MARTIN

EPSRC
Engineering and Physical Sciences Research Council

IET The Institution of Engineering and Technology

The organisers would like to thank the following delegate sponsors for their support:
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contents

welcome

From the Chair of the Global Grand Challenges Summit steering group

Dame Ann Dowling

As Chair of the international steering group, I would like to extend a warm welcome to you to the first Global Grand Challenges Summit.

The Summit – jointly organised by the UK, US and Chinese national academies of engineering – will see nearly 500 engineering thought leaders and future leaders from all three countries come together to discuss how engineering can contribute to solving the complex problems that will delimit humanity's progress over the next century.

I am extremely impressed by the quality of high level speakers at this summit: including Bill Gates, Craig Venter, Robert Langer, Frances Arnold, Lord Darzi, Jo da Silva, Jeffrey Sachs and Regina Dugan, among many others. And I am delighted that these names have been complemented by a gallery of rising stars, including some of the leading Chinese engineers of their generation.

But this event is not about elite engineers from the UK, US and China talking amongst themselves. This is about the global engineering community coming together to radically rethink the way it innovates, educates and collaborates in order to better prepare for the complex challenges it will be called upon to address.

Our inspiration has been a 2008 US National Academy of Engineering report, Engineering Grand Challenges for the 21st Century. For this project, the NAE brought together a group of senior international researchers, businesspeople and policymakers to identify 14 engineering grand challenges that would drive the global research agenda in the 21st century.

I would like to see these challenges as a provocation, which we can use to untangle some fundamental issues about the place of engineering in the world. To what extent can an engineering systems approach inform international collaboration on grand challenges style projects? And how should we change the ways engineers interface with each other, and with different disciplines, policymakers, and publics, to make these projects a success?

Much hard work and support has brought us to this point. On behalf of the three organising academies, I would particularly like to thank our partners: Lockheed Martin, the UK's Engineering and Physical Sciences Research Council (EPSRC) and the IET. Microsoft has sponsored a Student day, and many universities and businesses on both sides of the Atlantic have supported the attendance costs of younger attendees. I would also like to credit the excellent work of my fellow steering group members, including Dean Thomas Katsouleas of Duke University, Dean Richard Miller of Olin University, Dean Yannis Yortsos of USC, and Tony Hey, Vice President of Microsoft Research, in helping to organise this event. Finally, I would like to give particular thanks to the Academy staff who have worked tirelessly over many months to ensure the success of this Summit.

This will be the start of a long conversation. But already there are encouraging signs that our Summit will have a broader impact on the role of engineering in today's complex world. I hope that the discussions you participate in today will give you the ideas, connections and enthusiasm to take the next steps on this necessary and exciting journey.

Ann Dowling

> "This is about the global engineering community coming together to radically rethink the way it innovates, educates and collaborates in order to better prepare for the complex challenges it will be called upon to address."

global grand challenges summit agenda

Tuesday 12 March

Tuesday 12 March

8.00am Registration and welcome reception

9.00am **WELCOME**
Welcome by Chair – **Professor Dame Ann Dowling**,
Head of the Department of Engineering, University of Cambridge

9.10am Welcome Address by **Sir John Parker**, President, the Royal Academy of Engineering, with responses from **Professor CD Mote Jr**, Officer and President-nominee, US National Academy of Engineering (NAE) and **Dr Jian Song**, Honorary Chairman, Governing Board of the Chinese Academy of Engineering (CAE)

9.25am **PLENARY ADDRESS**
Address by **Dr J Craig Venter**, Founder, the J. Craig Venter Institute
20 minutes speaking followed by Q&A

10.10am Break

10.50am **SUSTAINABILITY**

Keynote speaker
Professor Jeffrey Sachs, Director, The Earth Institute, Columbia University

Professor Angela Belcher, Professor of Energy in Materials Science and Engineering and Biological Engineering, MIT

John Loughhead, Executive Director, UK Energy Research Centre

Allard Castelein, Vice President Environment, Shell

Professor Calestous Juma, Professor of the Practice of International Development, Harvard Kennedy School, Harvard University

12.20pm UK and US short film competitions – screening of runner-up films

12.30pm Lunch

1.50pm **HEALTH**

Keynote speaker
Dr Robert Langer, David H. Koch Institute Professor, MIT

Dr Frances Arnold, Professor of Chemical Engineering, Bioengineering and Biochemistry, Caltech

Professor Ara Darzi, Professor of Surgery, Imperial College London

Dr Rebecca Richards-Kortum, Director, Rice 360°: Institute for Global Health Technology

Dr Qimin Zhan, Vice President, Chinese Academy of Medical Sciences

3.15pm UK and US short film competitions - winning film screenings and trophy presentations

3.25pm Break

4.00pm **EDUCATION**

Keynote speaker
Professor John L Hennessy, President, Stanford University

Professor Dame Ann Dowling, Head of the Department of Engineering, University of Cambridge

Dean Kamen, Founder, FIRST

Robert H Matheson III, Principal, Wake NC State University STEM Early College High School

Professor Chris Wise, Co-founder, Expedition Engineering, and Professor of Civil Engineering Design, University College London

5.30pm Address by the **Rt. Hon. David Willetts MP**, Minister for Universities and Science

5.45pm Reception for all

global grand challenges summit agenda

agenda

Wednesday 13 March

Wednesday 13 March

8.00am Welcome reception

9.00am Introduction

9.05am **ENRICHING LIFE**

Keynote speaker
Professor Neil Gershenfeld, Director, Centre for Bits and Atoms, MIT

Dr Eric Brown, Director of Watson Technologies, IBM Research

Alexandra Daisy Ginsberg, Design Fellow on Synthetic Aesthetics, Stanford University and University of Edinburgh

Professor Helen Storey, Co-founder, Catalytic Clothing, and Professor of Fashion and Science, University of the Arts London (LCF at Centre for Sustainable Fashion)

10.30am Break

11.00am **TECHNOLOGY AND GROWTH**

Keynote speaker
Dr Mike Lynch, Founder, Invoke Capital

Dr Margaret Anne Craig, Chief Executive Officer, Clyde Biosciences

Dr Regina E Dugan, Senior Vice President, Advanced Technology and Projects (ATAP), Motorola Mobility

Professor Andy Hopper, President, the IET, and Head of the Computer Laboratory, University of Cambridge

Andrew Simms, Fellow, New Economics Foundation

Dr Li Yingtao, President, The 2012 Laboratories, Huawei Technologies Co. Ltd

12.20pm Presentation from the Grand Challenges Student Day

12.30pm Lunch

1.50pm **RESILIENCE**

Keynote speaker
Jo da Silva, Director of International Development, Arup

Bran Ferren, Co-founder and Chief Creative Officer, Applied Minds

Dr Paul Golby, Chair, the Engineering and Physical Sciences Research Council and Non-executive Director, National Grid

Professor Robert Mair, Head of Civil and Environmental Engineering, University of Cambridge

Dr Jianyun Zhang, President, Nanjing Hydraulic Research Institute

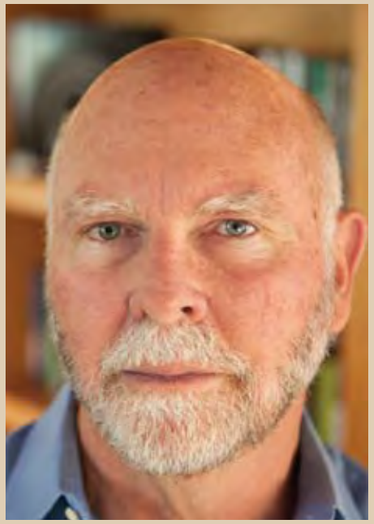
3.10pm Break

3.45pm **PLENARY ADDRESS**
Address and Q&A from **Bill Gates**, Co-chair and Trustee, Bill and Melinda Gates Foundation (by video link)

4.30pm **NEXT STEPS**
Final discussion, led by a panel of rising stars in engineering and intersecting fields, on how the grand challenges agenda can be used to drive change in the future

5.30pm Ends

The prosperity of future generations relies on unprecedented levels of inter-disciplinary and international co-operation in pursuit of solutions to global challenges. Whether the task be providing clean water for a soaring global population, or developing the resilience of our infrastructure to climate change, solutions demand more than isolated efforts. Instead, it is time to explore what could be accomplished with a globally-integrated systems approach.



J Craig Venter

Dr J Craig Venter is a biologist renowned for his contributions in sequencing the first draft human genome in 2001, the first complete diploid human genome in 2007 and construction of the first synthetic bacterial cell in 2010. He is founder, chairman and CEO of the J Craig Venter Institute (JCVI) and founder and CEO of the company Synthetic Genomics Inc (SGI).

Craig and his teams are focused on a variety of projects and programs including: synthetic genomic research and the application of these advances to develop new biofuels, vaccines and food and nutritional products; continued analysis of the human genome including the human microbiome; and discovering and understanding genetic diversity in the world's oceans. He is a recipient of the 2008 National Medal of Science, a member of the National Academy of Sciences and the author of A Life Decoded: My Genome: My Life (2007).

Bill Gates

Bill Gates is co-chair of the Bill & Melinda Gates Foundation. In 1975, Bill Gates founded Microsoft with Paul Allen, and led the company to become the worldwide leader in business and personal software and services. In 2008, Bill transitioned to Chairman of Microsoft to focus full-time on his foundation's work to expand opportunity to the world's most disadvantaged people.

Along with co-chair Melinda Gates, he leads the foundation's development of strategies and sets the overall direction of the organisation. In 2010, Bill, Melinda and Warren Buffett founded the Giving Pledge, an effort to encourage the wealthiest American families and individuals to publicly commit more than half of their wealth to philanthropic causes and charitable organizations during their lifetime or in their will.

academy hosts

Dan Mote

Dan Mote received the Founders Award of the National Academy of Engineering and the American Society of Mechanical Engineers (ASME) Medal in recognition of his work providing results of great practical importance in the vibration and stability of rotating and translating flexible structures, in the biomechanics of snow skiing injury and also for academic leadership.

He serves on the National Research Council Governing Board, the National Academy of Engineering Council as an officer and co-chairs the Academies Government-University-Industry Research Roundtable. He served as president of the University of Maryland for 12 years and on the University of California, Berkeley faculty for 31 years. He was awarded the Humboldt Prize by the Federal Republic of Germany; Fellowship of the American Academy of Arts and Sciences; Honorary Fellowship of ASME; the University of California, Berkeley Distinguished Teaching Award and its Distinguished Engineering Alumnus Award.

John Parker

Sir John Parker is the President of the Royal Academy of Engineering. He has chaired five FTSE100 companies, including National Grid, from which he stepped down in December 2011, and is currently Chairman of the mining conglomerate Anglo American. He is Vice Chairman of DP World (Dubai) and a Non-Executive Director of Carnival Corporation and EADS (Airbus).

Elected to the Royal Academy of Engineering as one of its youngest Fellows in 1983, Sir John is also an Elder Brother of Trinity House, a Visiting Fellow of University of Oxford, a member of the General Committee of Lloyds Register of Shipping, Vice President of The Royal Navy and Marines Charity and a governor of the Royal National Lifeboat Institution. He is a recipient of honorary doctorates from a number of universities in the UK and Ireland. He has been President of the Royal Institution of Naval Architects, Prime Warden of the Worshipful Company of Shipwrights, an Honorary Freeman of the Worshipful Company of Fuellers and the Tallow Chandlers Livery Company and President of the Smeatonian Society of Civil Engineers.

He led National Grid's Young Offenders into Work programme. He has served the government on the Prime Minister's Business Council for Britain, the Defence Academy Advisory Board, the Asia Task Force and was Deputy Chairman of the White Ensign Association.

Jian Song

Dr Jian Song is Honorary Chairman of the Governing Board of the Chinese Academy of Engineering, and Chairman of the All-China Environment Federation. He has made tremendous achievements in the fields of control theory, guided missile and aerospace technology, and population control theory. He made significant contributions to the development of S&T and environmental protection in China and he proposed Nation Building through Technology and Education, which is now one of three key national development strategies.

Song's previous positions include the Vice-Minister and Chief Engineer-Scientist of the Ministry of Astronautics, Chairman of the State Science and Technology Commission, President of Chinese Academy of Engineering, and First Vice-Chairman of Committee on Academic Degrees of China's State Council.

His academic titles include Academician of the Chinese Academy of Sciences and the Chinese Academy of Engineering; Honorary Professor of the Academy of Mathematics and System Sciences, and the Chinese Academy of Sciences; Foreign Associate of the US National Academy of Engineering; Foreign Member of Royal Swedish Academy of Engineering Sciences; and Member of the International Astronautic Academy.

Honors and awards conferred to Song including: the highest National Award for Scientific and Technological Progress for his achievements in population control study; the Albert Einstein Award; China's National Natural Science Prize; and the HLHL Award.

moderator

Jim Al-Khalili

Jim Al-Khalili is a professor of physics, author and broadcaster based at the University of Surrey where he currently teaches and also holds a chair in public engagement in science. He received his PhD in nuclear physics in 1989 and remains active in research in theoretical physics. He is active as a science communicator and has written a number of popular science and history of science books, between them translated into over twenty languages. His latest is Paradox: The Nine Greatest Enigmas in Physics.

Jim is a regular presenter of TV science documentaries, including the Bafta nominated Chemistry: A Volatile History and, most recently, Shock and Awe: The Story of Electricity and Order and Disorder, both for BBC4. He also presents the weekly BBC Radio 4 programme, The Life Scientific. He provides expert advice for bodies such as the Royal Society, the British Council and the Department for Education. He is also active in public life and is a strong advocate for rationalism and secularism and has recently taken over as president of the British Humanist Association. He is a recipient of the Royal Society Michael Faraday medal and the Institute of Physics Kelvin Medal. He was appointed Officer of the Order of the British Empire in 2008.

sustainability

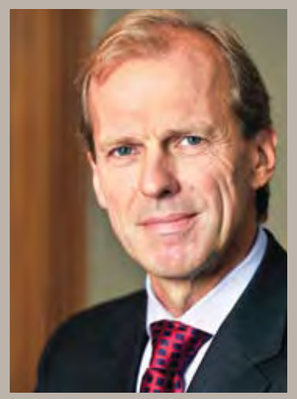
Climate change and the impact of population growth on resources are among the greatest risks to mankind's existence, yet efforts to mitigate these risks have been partial and haphazard. There is still no consensus on how sustainable development can be reconciled with strong growth in emerging and developing economies that is lifting billions out of poverty. This session asks whether a global systems approach to engineering innovation can bolster political efforts to reconcile economic growth with environmental sustainability. It brings together senior speakers who are deeply engaged in promoting sustainable futures: from encouraging sustainable growth in the developing world to investigating revolutionary future energy technologies; from reducing the carbon footprint of a major energy company, to demonstrating how small lifestyle changes can have massive environmental impacts.

Professor Angela Belcher

Angela Belcher is a Materials Chemist with expertise in the fields of biomaterials, biomolecular materials, organic-inorganic interfaces & solid state chemistry. Her primary research focus is evolving new materials for energy, electronics & the environment. She received her BS in Creative Studies with an emphasis in biology, and a PhD in Inorganic Chemistry in 1997 from The University of California, Santa Barbara.

Following a year of postdoctoral research in electrical engineering, Angela joined the faculty at The University of Texas at Austin in the Department of Chemistry in 1999. She joined the faculty at MIT in 2002 and now holds the W.M. Keck Chair in Energy. She founded the companies Cambrios Technologies, Inc. in 2002, and Siluria Technologies, Inc. in 2007.

Angela was elected to the American Academy of Arts & Sciences in 2012 and received the Eni Prize for Renewable and Non-conventional Energy in 2010. In 2007, Time Magazine named her a "Hero" for her research related to Climate Change. In 2006, she was named Research Leader of the Year by Scientific American and was awarded the Popular Mechanics Breakthrough Award. In 2005, she was named as one of 10 to watch by Fortune magazine for "how the world will work in the next 75 years."



Allard Castelein

Allard Castelein joined Shell in The Netherlands in 1987. For the first couple of years he held roles in trading, sales and marketing. From 1992 he lived and worked in Malaysia, Hong Kong, Saudi Arabia and the United Kingdom in various roles in marketing, planning consultancy, business development and general management.

In 2002 Allard returned to The Netherlands to join the Executive Board of the Nederlandse Aardolie Maatschappij, a Shell-Exxon JV. In 2003 he became Commercial Manager for Shell's European Upstream business. In this role he led a major reorganisation and change management program. Since mid-2009, Allard is Vice President Environment for Shell. He leads the Environment function and is accountable for strategy, standards, controls and strategic partnerships.

Born in Rotterdam, The Netherlands, in 1958, Allard graduated in medicine at Erasmus University. He holds non-executive and advisory positions with the World Environment Center, the International Petroleum Industry Environmental Conservation Association, the X Prize Foundation and The Netherlands 2028 Olympic bid.

> "There is still no consensus on how sustainable development can be reconciled with the strong growth in emerging and developing economies that is lifting billions out of poverty."

sustainability speakers

Calestous Juma

Professor Calestous Juma is an internationally recognized authority on the application of science and technology to sustainable development. He is Professor of the Practice of International Development and Director of the Science, Technology, and Globalization Project at Harvard's Kennedy School. He directs the school's Agricultural Innovation in Africa Project, funded by the Bill and Melinda Gates Foundation.

Calestous sits on the selection jury of the Queen Elizabeth Prize for Engineering and co-chairs the African Union's High Level Panel on Science, Technology and Innovation. After receiving his DPhil in science and technology policy studies in the UK, he founded the African Centre for Technology Studies in Nairobi, the continent's first independent think tank on innovation. He is a former executive director of the UN Convention on Biological Diversity, former Chancellor of the University of Guyana and has been a member of the governing boards of leading international organisations working on sustainable development.

A Kenyan national, Calestous has been elected to several prestigious academies including the Royal Society of London, the US National Academy of Sciences, the Academy of Sciences for the Developing World (TWAS), the UK Royal Academy of Engineering and the African Academy of Sciences. He has received numerous international awards and honorary degrees.

John Loughhead

John Loughhead is Executive Director of the UK Energy Research Centre, a distributed organisation drawing together 150 academic researchers and some 30 universities which is the focal point of the UK energy research programme. He was previously Vice-President of the Alstom group.

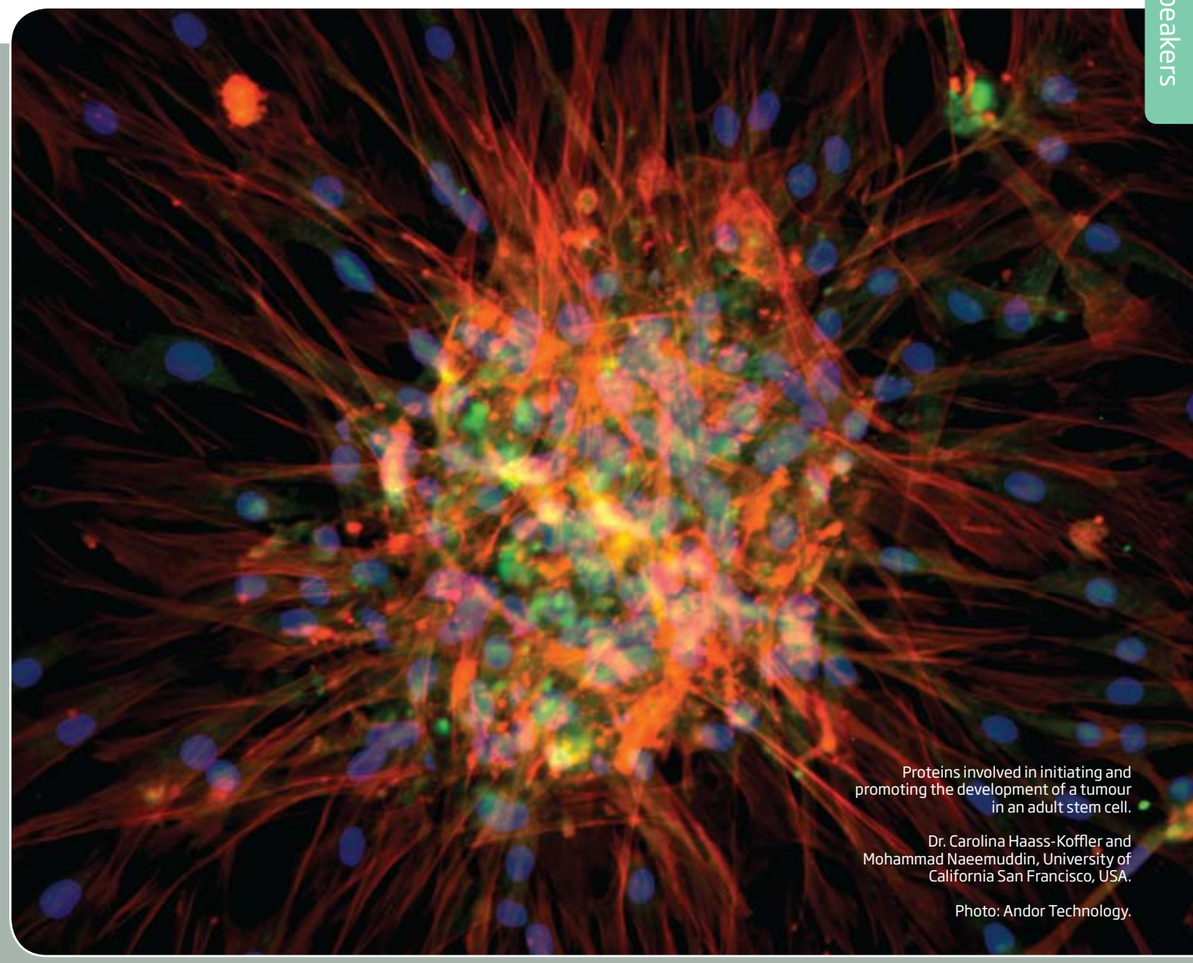
He has been active in energy systems research for over 30 years, developing new generation, conversion and system technologies, and has extensive interactions with UK and international government bodies on energy policy development and new technology deployment. He has recently been appointed the UK-China Science Focal Point for Energy and Renewables.

John is a graduate in Mechanical Engineering from Imperial College, London, where he also spent five years in computational fluid dynamics research. He is Past-President of the UK's Institution of Engineering and Technology, Fellow of the UK and Australian national academies of engineering, Professor of Engineering at Cardiff University and Fellow of Queen Mary University of London.

Jeffrey Sachs

Professor Jeffrey Sachs is a world-renowned professor of economics, leader in sustainable development, senior UN advisor, bestselling author, and syndicated columnist whose monthly newspaper columns appear in more than 80 countries.

Jeffrey serves as the Director of The Earth Institute, Quetelet Professor of Sustainable Development, and Professor of Health Policy and Management at Columbia University. He is Special Advisor to United Nations Secretary-General Ban Ki-moon on the Millennium Development Goals, having held the same position under former UN Secretary-General Kofi Annan. He is co-founder and Chief Strategist of Millennium Promise Alliance, and is Director of the Millennium Villages Project. He is also Director of the UN Sustainable Development Solutions Network. He has authored three New York Times bestsellers in the past seven years: The End of Poverty (2005), Common Wealth: Economics for a Crowded Planet (2008), and The Price of Civilization (2011).



Proteins involved in initiating and promoting the development of a tumour in an adult stem cell.

Dr. Carolina Haass-Koffler and Mohammad Naeemuddin, University of California San Francisco, USA.

Photo: Andor Technology.

health

This session showcases the contribution of engineering research to the frontiers of healthcare, from bioengineering, to new surgery and imaging techniques, to regenerative and personalised medicine. It asks how these new technologies and related advances in data and information technology can be mobilised and built on in the coming decades to enhance the quality of care available in our clinics and hospitals, to provide our ageing populations with better opportunities for an active and independent old age, and to offer a healthier future to the developing world.

Frances Arnold

Dr Frances Arnold is the Dick and Barbara Dickinson Professor of Chemical Engineering, Bioengineering and Biochemistry at the California Institute of Technology (Caltech). Her research focuses on directed evolution of enzymes and biosynthetic pathways, with applications to alternative energy, chemicals, and medicine. Frances received her bachelors degree in mechanical and aerospace engineering from Princeton University in 1979.

Frances was awarded her doctorate in chemical engineering at the University of California-Berkeley. After postdoctoral work, she joined the Caltech faculty. She has received numerous honours and awards including the US National Medal of Technology and Innovation and the Charles Stark Draper Prize of the US National Academy of Engineering. She is the only woman to be elected to membership in all three US national academies: the Institute of Medicine, the National Academy of Engineering, and the National Academy of Sciences.

An Advisory Board member of the Joint BioEnergy Institute and the Packard Fellowships in Science and Engineering, Frances also serves on the President's Advisory Council at KAUST and is a judge for The Queen Elizabeth Prize for Engineering. Frances has served on the science advisory boards of numerous companies, including Gevo, Inc., which she co-founded in 2005. She has co-authored over 200 publications and is co-inventor on 36 US patents.

Ara Darzi

Lord Darzi holds the Paul Hamlyn Chair of Surgery at Imperial College London. He is an Honorary Consultant Surgeon at Imperial College Hospital NHS Trust and the Royal Marsden Hospital, and holds the Chair of Surgery at the Institute of Cancer Research. In October 2010, he was appointed as Chairman for the Institute of Global Health Innovation at Imperial College. In 2012, he took up the role of Chair, Imperial College Health Partners.

He was knighted for his services in medicine and surgery in 2002; in 2007 he was introduced to the United Kingdom's House of Lords and appointed Parliamentary Under-Secretary of State at the Department of Health. He relinquished this role in July 2009 when he was appointed the United Kingdom's Global Ambassador for Health and Life Sciences, a role reconfirmed in 2010 by Prime Minister David Cameron. He was appointed as a member of Her Majesty's Most Honourable Privy Council in June 2009. He is an Honorary Fellow of the Royal Academy of Engineering.

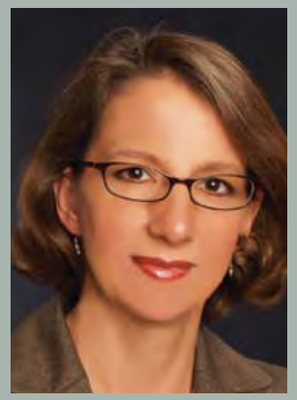
Robert Langer

Professor Robert Langer is an Institute Professor at Massachusetts Institute of Technology (MIT). Being an Institute Professor is the highest honour that can be awarded to a faculty member. He has written over 1,170 articles and has nearly 800 issued or pending patents.

Robert has received over 170 major awards include the US National Medal of Science, the Millennium Technology Prize, the Charles Stark Draper Prize, the Albany Medical Center Prize and the Lemelson-MIT prize, for being "one of history's most prolific inventors in medicine." He is one of the few individuals ever elected to all three US national academies: the Institute of Medicine, the National Academy of Engineering, and the National Academy of Sciences.

Forbes Magazine selected Robert as one of the 15 innovators worldwide who will reinvent our future. Time Magazine and CNN named him as one of the 100 most important people in America and one of the 18 top people in science or medicine in America (America's Best).

Robert has received honorary doctorates from Harvard University, the Mt. Sinai School of Medicine, Yale University, and the ETH (Switzerland) among numerous others. He received his Bachelor's Degree from Cornell University in 1970 and his Sc.D. from MIT in 1974, both in Chemical Engineering.



Rebecca Richards-Kortum

Rebecca Richards-Kortum is Stanley C. Moore Professor of Bioengineering and Chair of Bioengineering at Rice University. She is a member of the US National Academy of Engineering, the American Institute for Medical and Biological Engineering, the American Association for the Advancement of Science, and the Biomedical Engineering Society. She has won numerous awards for her teaching and research.

Rebecca's lab develops inexpensive, portable optical imaging systems that provide point-of-care diagnosis for cancer, pre-cancer, and infectious disease in low-resource settings. These technologies have been applied in the US, Botswana, Brazil, China, India, Mexico, and Taiwan.

In 2006, Rebecca founded the HHMI-supported program Beyond Traditional Borders (BTB), a minor in global health technologies that has engaged more than 10% of Rice's undergraduates. Students have designed more than 50 technologies that have been used by physicians in 19 countries in Africa, Latin America, and the Caribbean. BTB won the Science Prize for Inquiry-Based Instruction in 2012.

Qimin Zhan

Dr Qimin Zhan is Vice President of Chinese Academy of Medical Sciences and Director of the State Key Laboratory of Molecular Oncology. He trained at Suzhou University Medical College and the Peking Union Medical College and obtained postdoctoral experience at the University of California, University of Texas, Southwestern Medical Centre at Dallas and the National Cancer Institute of National Institutes of Health, and was a tenured faculty member in the University of Pittsburgh School of Medicine.

He is currently a Professor at Peking Union Medical College and a Senior Investigator in Chinese Academy of Medical Sciences Cancer Institute. Zhan is Chairman of the National Advisory Board for 863 High-Tech plan in biomedical sciences and Chief Scientist of the 973 National Fundamental Program (cancer field).
His research focus is the molecular pathways involved in controlling cell cycle checkpoint and apoptosis after DNA damage. He is also interested in signalling pathways involved in regulation of the maintenance of genomic stability and tumor metastasis. His research has attracted multiple grants. He has published over 130 peer-reviewed SCI papers in prestigious journals, including Cell, J Clin Invest, EMBO and Science, and these are highly cited in the biomedical field.

> "...these new technologies and related advances in data and information technology can be mobilised and built on in the coming decades to enhance the quality of care available in our clinics and hospitals..."

education

If we are to meet our global challenges, we need to educate a new generation of engineers who are more representative of our society, and have a portfolio of skills and attributes which go beyond traditional engineering curricula. To meet these needs, pioneering schools, universities and charities are re-examining some of the fundamental concepts of engineering education: including cherished notions of what a discipline consists of, what a university looks like, and what an engineer does. A panel of engineering education stakeholders will offer insights from their own experiences, and debate the risks and rewards of the upcoming revolution in engineering education.

Dame Ann Dowling

Dame Ann Dowling is Head of the Department of Engineering at the University of Cambridge where she is Professor of Mechanical Engineering and Chairman of the University Gas Turbine Partnership with Rolls-Royce. She has held visiting posts at MIT (Jerome C Hunsaker Visiting Professor, 1999) and at Caltech (Moore Distinguished Scholar, 2001). Her research is primarily in the fields of combustion, acoustics and vibration and is aimed at low-emission combustion and quiet vehicles. She is one of the founders of the Energy Efficient Cities initiative in Cambridge and was the UK lead of the Silent Aircraft Initiative, a collaboration between researchers at Cambridge and MIT.

Ann Dowling is a Fellow of the Royal Society and the Royal Academy of Engineering and is a Foreign Member of the US National Academy of Engineering and of the French Academy of Sciences. She has an Honorary ScD degree from Trinity College Dublin. Ann has served on a number of industry and government advisory committees and is a non-executive director of BP plc. She was appointed CBE by the Queen for services to mechanical engineering in 2002, and DBE for services to science in 2007.

John L Hennessy

Profesor John L Hennessy joined Stanford's faculty in 1977 and rose to full professorship in 1986.

From 1983 to 1993, John was director of the Computer Systems Laboratory for research in computer systems design. He was chair of computer science from 1994 to 1996 and then became dean of the School of Engineering. As dean, he launched a five-year plan that laid the groundwork for new activities in bioengineering and biomedical engineering. In 1999, he became provost, and in 2000, became Stanford's 10th president.

A pioneer in computer architecture, in 1981 John drew together researchers to focus on a computer architecture known as RISC (Reduced Instruction Set Computer). In 1984, he co-founded MIPS Computer Systems, now MIPS Technologies, which designs microprocessors. In recent years, his research has focused on the architecture of high-performance computers.

John is a recipient of numerous awards including a 2004 NEC C&C Prize for lifetime achievement in computer science and engineering, and the 2012 IEEE Medal of Honor. He is a member of the National Academy of Engineering and the National Academy of Sciences, and a fellow of the American Academy of Arts and Sciences, the Association for Computing Machinery, and the Institute of Electrical and Electronics Engineers.

Dean Kamen

Dean Kamen is the founder and president of DEKA Research & Development Corporation. Examples of technologies developed by DEKA include the HomeChoice™ portable dialysis machine, the iBOT™ Mobility System, the Segway™ Human Transporter, a DARPA-funded robotic arm, a new and improved Stirling engine, and the Slingshot water purifier.

Kamen has received many awards for his efforts, including the National Medal of Technology in 2000 and the Lemelson-MIT Prize in 2002. He was inducted into the National Inventors Hall of Fame in 2005 and has been a member of the National Academy of Engineering since 1997.

Among Kamen's proudest accomplishments is founding FIRST (For Inspiration and Recognition of Science and Technology), an organization dedicated to motivating the next generation to understand, use and enjoy science and technology.

Robert Matheson

Robert Matheson became Principal of the new Wake North Carolina State University STEM Early College High School (STEM ECHS) in November 2010. The STEM ECHS, located on NC State University's campus in Raleigh, NC, opened in August 2011 with an initial cohort of 55 ninth grade students. After a successful first year, the STEM ECHS added another 55 students.

From 2005-2010 Robert was the Assistant Principal for Instruction at Apex High School (AHS). Before returning to AHS in 2004 as the Intervention Coordinator, he was Director and a founding board member at Kestrel Heights School (public charter school, grades 6-10). Robert worked at AHS from 1991-98 as a biology teacher, and also served as chairman of both the Science Department and School Improvement Team.

Robert's experience prior to 1991 includes serving as: coordinator of a state-wide biotechnology education project for teachers; biology teacher at Broughton HS (Raleigh, NC); a seventh grade life science teacher at Ravenscroft School (Raleigh, NC); and fisheries biologist at the Duke University Marine Laboratory and National Marine Fisheries Service Laboratory in Beaufort, NC.

Robert received his B.S. and M.S. degrees in Zoology from North Carolina State University, and a Master of School Administration degree from North Carolina Central University.

Chris Wise

Professor Chris Wise began his career with Ove Arup and Partners, where he became Arup's youngest Director in 1992. In 1999, he left Arup to co-found Expedition. Chris is widely known for hands-on engineering projects, both as design lead and also in close working collaboration with some of the world's leading architects, including Richard Rogers, Renzo Piano, Michael Hopkins and Norman Foster.

Chris is a Fellow of the Royal Academy of Engineering, and a recipient of their prestigious individual honour, the Silver Medal. He is also a Past Master of the Royal Designers of Industry, as well as a Trustee of the Design Council. He writes and broadcasts on the theme of creative design in projects, and lectures widely to engineering and architectural students in the UK and abroad.

Chris is currently a Professor of Civil Engineering Design at University College London and was recently awarded Gold Medal awards by both the Institute of Civil Engineers (ICE) and Institution of Structural Engineers (IStructE).

> "...we need to educate a new generation of engineers who are more representative of our society, and have a portfolio of skills and attributes which go beyond traditional engineering curricula."

A patient at the Royal Berkshire Hospital in the UK uses Kinect as part of rehabilitation exercises. Patients at the hospital's Neurological Rehab Unit are matched to specific Kinect titles depending on the severity of their impairment. The games have helped improve patients' balance, coordination and physical movement.

Photo: Microsoft Corporation.

enriching life

Advances in information and communication technology have changed the ways we work, play and create in ways that were almost inconceivable 20 years ago. Researchers working at the interface between engineering and the creative arts are investigating other technologies which might have an equally radical impact on our lives. This session looks at emerging technologies – from 3D printing, to artificial intelligence, to synthetic biology, to clothing that cleans the air – and asks how they might enhance the art we make, the stories we tell, the ways we interact with each other, and the ways we understand ourselves.

enriching life speakers

Eric Brown

Eric Brown is the Director and Principal Investigator for Watson Technologies at the IBM T.J. Watson Research Center. Eric earned his BSc at the University of Vermont and MSc and doctorate at the University of Massachusetts, all in computer science. Eric joined IBM in 1995 and has conducted research in information retrieval, document categorization, text analysis, question answering, bio-informatics, and applications of automatic speech recognition.

Since 2007 Eric has been a technical lead on the DeepQA project at IBM and the application of automatic, open domain question answering to build the Watson Question Answering system. The goal of Watson is to achieve human-level question answering performance. This goal was realized in February of 2011 when Watson beat Ken Jennings and Brad Rutter in a televised Jeopardy! exhibition match. Eric's role on the project has spanned architecture development, special question processing, and hardware planning, and he is currently leading the team to apply Watson to clinical decision support in healthcare. Eric has published numerous conference and journal papers, and holds several patents in the areas of text analysis and question answering.

Neil Gershenfeld

Professor Neil Gershenfeld is Director of MIT's Center for Bits and Atoms. His laboratory is breaking down boundaries between the digital and physical worlds, from creating molecular quantum computers to virtuosic musical instruments. Technology from his lab has been used in settings including New York's Museum of Modern Art and rural Indian villages, the White House and the World Economic Forum.

He has authored numerous technical publications, patents, and books including Fab and The Physics of Information Technology. He is a Fellow of the American Physical Society, has been named one of Scientific American's 50 leaders in science and technology, as one of 40 Modern-Day Leonardos by the Museum of Science and Industry, has been selected as a CNN/Time/Fortune Principal Voice, and by Prospect/Foreign Policy as one of the top 100 public intellectuals.

Neil has a BA in physics from Swarthmore College, a PhD. in applied physics from Cornell University, and honorary doctorates from Swarthmore College and Strathclyde University. He was a Junior Fellow of the Harvard University Society of Fellows, and a member of the research staff at Bell Labs. He is the originator of the global network of field 'fab labs' that provide widespread access to prototype tools for personal fabrication, and directs the Fab Academy.

> "Advances in information and communication technology have changed the ways we work, play and create in ways that were almost inconceivable 20 years ago."

Alexandra Daisy Ginsberg

Alexandra Daisy Ginsberg is an artist, designer and writer, interrogating science, technology and new roles for design. As Design Fellow on Synthetic Aesthetics, an NSF/EPSRC-funded project between Stanford University and the University of Edinburgh, she curates an international programme investigating the 'design of nature', developing new modes of collaboration and critical discourse between art, design and synthetic biology.

Daisy studied architecture at the University of Cambridge, design at Harvard University, and gained an MA in Design Interactions at the Royal College of Art. Her work has been exhibited at MoMA, The Wellcome Trust, London's Design Museum, the Israel Museum and the National Museum of China, and is in Trento's Museo Delle Scienze's permanent collection. Daisy publishes, teaches and lectures internationally: talks include TEDGlobal and PopTech. In 2011, her work was nominated for the Brit Insurance Designs of The Year and the Index Award; she won the World Technology Award (Design), and in 2012 received the first London Design Medal for Emerging Talent.

Helen Storey

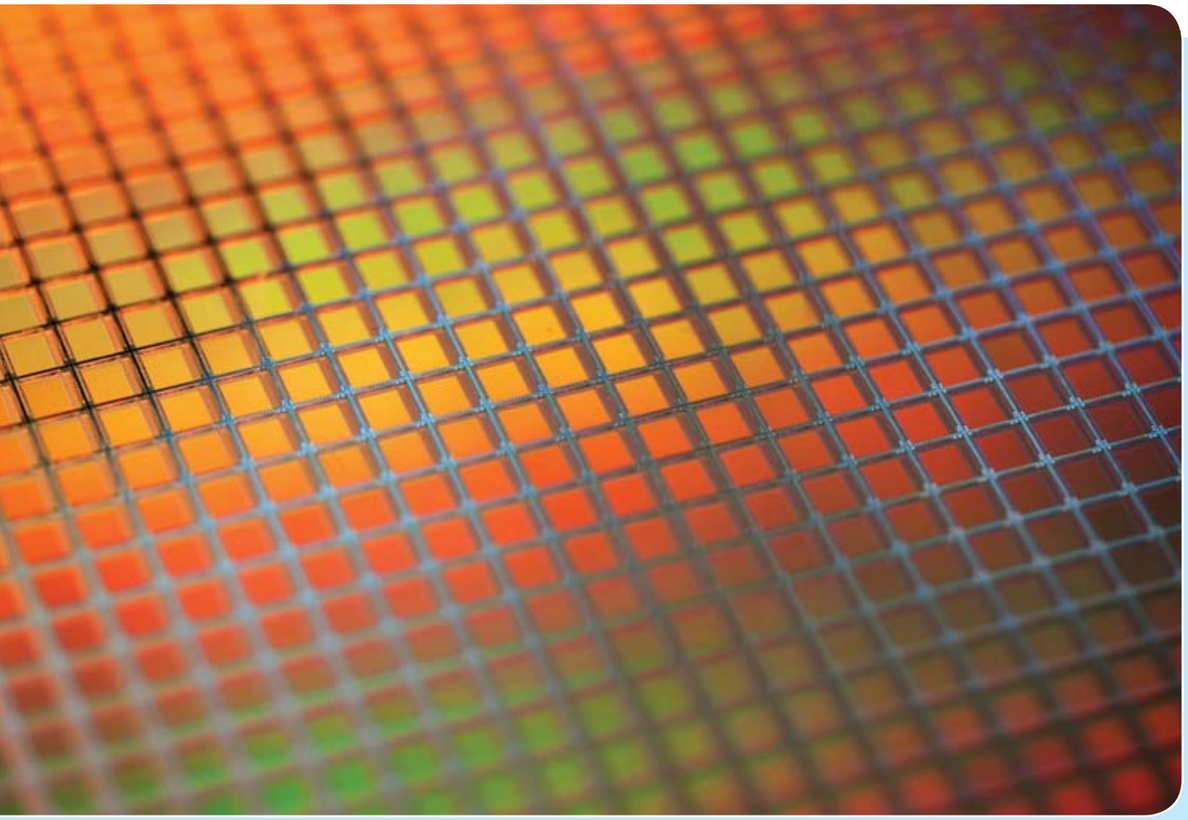
Professor Helen Storey is a London-based artist and designer. After graduation in fashion in 1981, she worked with Valentino and Lancetti in Rome. Returning to London, she worked with Bellville Sassoon before launching her own label in 1983. Helen won Most Innovative Designer Of The Year and was nominated for British Designer Of The Year by The British Fashion Council.

Since the mid-90s, Storey has been drawn towards the world of scientific research, resulting in award-winning cross-disciplinary projects exploring biology, neuroscience and chemistry. The Helen Storey Foundation was formed in 1997 to promote creativity and innovation.

Catalytic Clothing is Helen's latest award-winning project in collaboration with Professor Tony Ryan with whom she has worked since 2008. They have sought to deliver textile substrates (and therefore clothes) with a technology to purify air.

Helen holds Honorary Professorships at Heriot Watt University and King's College London. She is a visiting Professor of Material Chemistry at Sheffield University and a Professor in Craft and Design at Duncan of Jordanstone College of Art and Design. She is a Professor of Fashion and Science at The Centre for Sustainable Fashion at The London College of Fashion. She received the MBE for services to the Arts in June 2009.

> "This session looks at emerging technologies – from 3D printing, to artificial intelligence, to synthetic biology, to clothing that cleans the air..."



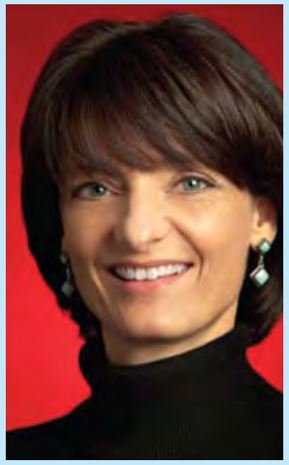
technology and growth

Across the world, governments are intent on promoting growth through innovation. But there is still much to learn about how best to encourage innovation. How do we ensure that the best research results in innovative products and services? How can the state support innovation and ensure the integrity of vibrant entrepreneurial activities? And is the pursuit of economic growth really sustainable in the long term, or should we focus business and research efforts on enhancing the quality of life? Is this a false choice? This session brings together world renowned business people and thinkers to debate the issues surrounding innovation and growth.

Margaret Anne Craig

Margaret Anne Craig graduated with a degree in Immunology/Pharmacology from the University of Strathclyde and went on to carry out a MSc and PhD at the University of Glasgow in the field of pathophysiology of cancer. She then took up a position as research associate at the University of Glasgow where she was involved in the development of biological assays and novel discovery platforms as well as cardiovascular physiology research.

Margaret Anne was awarded a BBSRC/RSE enterprise fellowship in 2011 which allowed her to spend one year developing her group's technologies, exploring the market potential and carrying out business training. During the course of the year, it became apparent that her group's technology had much commercial potential and they formed the spin-out company Clyde Biosciences. Last year Margaret won the Royal Academy of Engineering Entrepreneur for 2012 which has raised the profile of the company significantly. Subsequently, Clyde Biosciences has been shortlisted by the Times Higher Education awards for Outstanding Contribution to Technology and Innovation and by Scottish Enterprise as Innovators of the Year 2013. In her position as Chief Executive Officer, Margaret will play a major role in shaping Clyde Biosciences into a world-leading CRO company.



Regina Dugan

Dr Regina Dugan is Senior Vice President of the Advanced Technology and Projects for Motorola Mobility. She is responsible for building and leading the skunkworks-inspired team delivering breakthrough innovations.

Regina was most recently the Director of the US Defense Advanced Research Projects Agency (DARPA). She first served at DARPA as a program manager from 1996 to 2000, where she was named DARPA PM of the year in 1999, and was awarded the prestigious Bronze deFleury medal by the Army Engineer Regiment in 2000.

Prior to her appointment as Director of DARPA, Regina co-founded a niche investment firm, where she served as President and CEO; she has served as founder and senior executive in several commercial companies with diverse products.

Widely recognized for her leadership in innovation and technology development, Regina has been featured in The New York Times, The Wall Street Journal, Forbes, and Science News, among others. She obtained her doctoral degree in mechanical engineering from the California Institute of Technology and her master's and bachelor's degrees from Virginia Tech. She is co-author of Engineering Thermodynamics (1996), and a sole inventor or co-inventor on multiple patents and patents pending.

Andy Hopper

Andy Hopper is Professor of Computer Technology and heads up the Computer Laboratory at the University of Cambridge. With a long history of turning innovative research and technology into commercial success, he has co-founded a dozen start-ups, three of which have floated on stock markets. He is also Chairman of RealVNC and Ubisense, both borne out of research by Cambridge University graduates and both winners of two Queen's Awards for Innovation and International Trade. This achievement reflects Andy's unique ability to successfully bridge the gap between academia and industry.

Andy is President of the Institution of Engineering and Technology, a Fellow of the Royal Academy of Engineering and the Royal Society, and in 2007 was made a Commander of the Order of the British Empire (CBE) for services to the computer industry. His current research interests include computer networking, pervasive and sensor-driven computing and using computers to ensure the sustainability of the planet.

Born in Warsaw, Poland in 1953 and a UK citizen since 1964, Andy received a BSc degree from the University of Wales Swansea and a PhD from the University of Cambridge.

technology and growth speakers

Mike Lynch

Dr Mike Lynch is founder of Invoke Capital. He has long been regarded as a visionary figure within the technology world, described by the Financial Times as "the doyen of European software". He advises the Prime Minister on science policy matters through the Council on Science and Technology. Mike founded Autonomy in 1996, the UK's largest and fastest-growing software company, and was its CEO for fifteen years. In addition he has founded or advised several companies ranging from Neurodynamics to Blinkx. He has invested in numerous start-ups and has advised venture capital and private equity groups.

Alongside his entrepreneurial career, Mike has a number of board seats and advisory roles. He is a non-executive director of the British Library and Cambridge Enterprise and a council member of the Royal Academy of Engineering and of the Foundation for Science and Technology. He is a member of the advisory board of Tech City's Investment Committee, an advisor to the Prince's Trust technology group and a founding investor of Bridges Venturing.

During his career, Mike has received many awards and accolades including induction into the Digital Hall of Fame in 2012 and receiving the Outstanding Contribution award in the UKIT Industry awards.

Andrew Simms

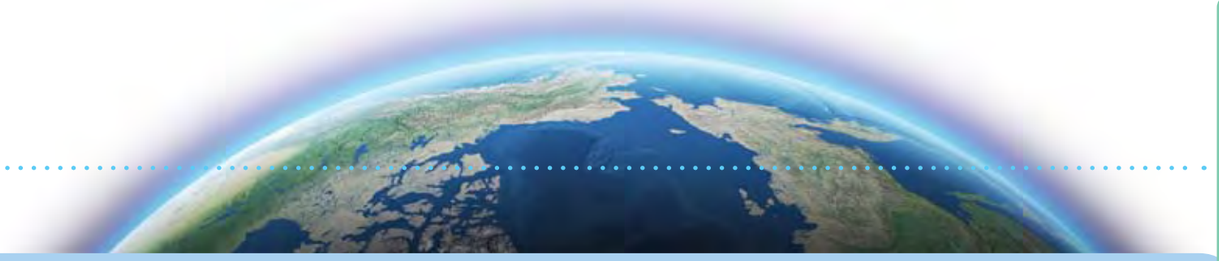
Andrew Simms is the author of several books including Ecological Debt and the bestselling Tescopoly. He is a Fellow of nef (the new economics foundation) where he was policy director for many years, trained at the London School of Economics and was described by New Scientist magazine as, 'a master at joined-up progressive thinking.' He is also one of the UK's leading campaigners who co-authored the ground-breaking Green New Deal, was one of the original organisers of the campaign to cancel poor country debt, and devised how to mark the day in the year when the world enters 'ecological debt.' He also coined the term 'Clone Towns' in work pioneering new ways to revive local economies and recently proposed the idea of 'National Gardening Leave,' combining a shorter working week with urban greening. He has witnessed first hand for more than twenty years failed international efforts to solve critical economic and environmental problems, from extreme poverty to climate change. His new book Cancel the Apocalypse: the New Path to Prosperity, newly published by Little Brown in 2013, is the result of his search for something better.

Li Yingtao

Born in 1969, Dr Li Yingtao holds a doctorate degree from Harbin Institute of Technology. Yingtao joined Huawei in 1997 and has served as Chief of the Sweden Research Centre, Director of the Product Management Department of Wireless Marketing, Director of the Research Department of Products and Solutions and Director of the General Technology Office of Products and Solutions. He has also been President of the Central Research & Development Unit, President of the 2012 Laboratories, Director of the Integrated Technology Management Team, a member of the Human Resources Committee, and a member of the Strategy and Development Committee.

resilience

New technologies provide better ways of predicting, preventing and responding to natural disasters and preparing ourselves for future extreme events, terror strikes, pandemics and climate shocks. But they also bring new dependencies and new threats. In this session, five senior speakers will discuss the latest engineering research and practice on disaster relief, flood prevention, cybersecurity, and energy security; they will also look at ways that concepts of resilience and risk can be better incorporated into the development of new infrastructures and technologies.



Jo da Silva

Jo da Silva is a Director at Arup where she founded Arup International Development, a not-for-profit business which provides strategic advice and technical expertise to organisations committed to creating sustainable and resilient communities. She is a civil engineer whose career began in India and has subsequently encompassed the design and construction of buildings and infrastructure in four continents, as well as extensive experience working in post-disaster situations. She has particular expertise in improving access to essential services, low income housing and human settlements, urban infrastructure, post-disaster recovery and reconstruction, disaster risk reduction and climate change adaptation.

Jo sits on the International Development Policy Group at the Institution of Civil Engineers and lectures at the Centre for Sustainable Development at the University of Cambridge. In 2009, she was elected a Fellow of the Royal Academy of Engineering and in 2011 became an Officer of the British Empire (OBE) for services to engineering and to humanitarian relief. In 2012, she became the first woman to be selected by the ICE to deliver the prestigious, 9th International Brunel Lecture, entitled 'Shifting Agendas: from response to resilience – the role of the engineer in disaster risk reduction'.

Bran Ferren

Bran Ferren, a designer and technologist, is Co-Founder and Chief Creative Officer of Applied Minds LLC, which invents and prototypes high-technology products and innovative business concepts for the aerospace, defence, intelligence, automotive, architecture, computing, and consumer products sectors. He is former President of Research & Development and Creative Technology for the Walt Disney Company. Before that, he was President and Senior Designer for Associates & Ferren, which Disney acquired in 1993.

Bran works primarily as lead concept designer, systems engineer, and technologist, and is named inventor on approximately 300 current and pending US patents. He is an Oscar-nominated film visual effects designer and award-winning Broadway special effects, lighting, and sound designer. Other conceptual design work includes consumer products, World's Fairs, theme parks, music tours, building architecture, and special purpose vehicles.

Design, engineering and technical clients include the Walt Disney Company, Northrop Grumman, Lockheed Martin, General Motors, IBM, Warner Communications, and Sony. He is a member of the Academy of Motion Picture Arts and Sciences and the Academy of Television Arts and Sciences. He has been a senior advisory board member for science, advanced technology, and innovation management to over a dozen Government and military agencies and the US Senate.

Paul Golby

Following a successful executive career in the Energy Industry, Dr Paul Golby has a portfolio of non-executive roles in the private and public sectors. Following a series of management appointments with Dunlop and BTR, he joined the Board of the 'mini conglomerate' Clayhithe plc in 1992. Joining East Midlands Electricity in 1998, he became Chief Executive of E.ON UK in 2002. He built the business to become one of the UK's leading energy companies. He retired from E.ON in December 2011.

Paul is currently a non-executive director of National Grid plc, Chairman of Engineering UK, Chairman of the Engineering and Physical Sciences Research Council, and a Member of the Prime Minister's Council for Science and Technology. He is a Council Member of the Royal Academy of Engineering and a fellow of the Royal Academy of Engineering, the Institution of Engineering and Technology, the Institution of Mechanical Engineers, and the Energy Institute.

He was awarded honorary degrees from Aston University in 2007 and Cranfield University in 2008 and made a CBE in 2011.

Zhang Jianyun

Dr Zhang Jianyun graduated from the East China Technical University of Water Resources in 1982, and obtained an MSc in engineering from Hohai University in 1987. From the National University of Ireland, he received an MSc in 1992 and a PhD in civil and environmental engineering in 1996.

Jianyun has led research in hydrology, hydrological modelling, flood forecasting, flood control, drought relief, impacts of climate change and hydroinformatics. As Chief Engineer of the Bureau of Hydrology in the Ministry of Water Resources, he oversaw flood forecasting of the whole country during 1998-2006. He also presided over the development of numerous software systems, such as National Flood Forecasting System, and Decision Supporting System for National Flood Controlling. He led the design of the National Flood Control and Drought Relief Command System (NFCDRCS) as well as the technical work for the construction of the system.

Jianyun has led over 20 Key National Research Programs, such as the National Science and Technology Research Program. He received one First Grade Prize and four Second Grade Prizes from the National Awards for Science and Technology Progress. He has published 5 monographs and over 100 papers. He was elected to membership of Chinese Academy of Engineering in 2009.

Robert Mair

Professor Robert Mair is the Sir Kirby Laing Professor of Civil Engineering and Head of Civil and Environmental Engineering at Cambridge University. He was Master of Jesus College between 2001 and 2011 and Senior Vice-President of the Royal Academy of Engineering from 2008 to 2011. Before he was appointed to a Professorship at Cambridge in 1998, he worked in industry for 27 years and in 1983 founded the Geotechnical Consulting Group, an international consulting company.

His research group specialises in the geotechnics of tunnelling and underground construction. He leads the Centre on Smart Infrastructure and Construction at Cambridge, involving the innovative use of the latest sensor technologies to monitor the behaviour of civil engineering infrastructure.

Professor Mair has advised on many infrastructure projects worldwide, and is a member of the Expert Panel on Crossrail, Europe's largest civil engineering project. He chaired the Royal Society/Royal Academy of Engineering Report on Shale Gas for the UK Government, published in 2012.

> "New technologies provide better ways of predicting, preventing and responding to natural disasters and preparing ourselves for future extreme events, terror strikes, pandemics and climate shocks."

next steps panel

>> Yewande Akinola

Yewande is an engineer with engineering consultancy, ARUP. She holds engineering and innovation degrees from the University of Warwick and Cranfield University. Her innovation expertise informs her interests in the development of appropriate technologies for developing countries and emerging markets. She enjoys media work and has presented engineering programmes for TV. She is currently the Institute of Engineering and Technology (IET) Young Woman Engineer of the Year. In her spare time she enjoys building house models, reading and exploring new places.

>> Jared Dunnmon

Jared Dunnmon is a current MBA candidate at Oxford University who is particularly interested in developing holistic solutions to energy and infrastructure problems. After studying mechanical engineering and economics at Duke University as an undergraduate, Jared has spent the last two years as a Rhodes Scholar focusing his activities on creating mathematical models of complex energy generation systems and developing concrete implementation strategies for emerging technologies of high social value. Jared will begin his doctoral work in Mechanical Engineering this coming September with an intended focus on both modeling and design of flexible-fuel large scale combustion systems.

>> Eleanor Stride

Eleanor Stride obtained her BEng and PhD in Mechanical Engineering from UCL. Following the completion of her PhD in 2005, she was appointed to a lectureship and a Royal Academy of Engineering and EPSRC Research Fellowship. In addition to over 90 academic papers, her work has led to new patented technologies for agents for ultrasound imaging and therapy, and she has recently set up a spin-out company in this area. In 2011, she moved to the University of Oxford, where she continues her research in encapsulation, ultrasound therapy and medical imaging.

global grand challenges summit short film competition

Q&A

UK Short Film Competition winner
Paul Clarkson

Q: Tell us about yourself

A: I was raised in Bolton and ever since I was a child I'd always wanted to be an actor. As I grew older, I realised I had a love of writing instead of acting and before my GCSE's I wanted to be a writer and film director instead. But then I started GCSE physics. My mind was introduced to a totally new world that stretched from the atomic scale to the cosmic. I was very lucky, my physics teacher used to do stand up comedy – chain reactions in nuclear physics was taught by a revision of Diana Ross' 'I'm in the middle of a chain reaction'! Thanks to my fantastic teacher I soon became enthralled with science and so I studied nuclear physics at Birmingham University. I never really lost touch with writing though, and continued to pursue this in my spare time. After graduating from Birmingham University with a master's degree in nuclear physics, I joined the Rolls-Royce graduate scheme, eventually moving to the Strategic Research Centre. Here, I work with my colleagues to develop design solutions and technologies of the future. In my spare time I write theatre and screenplays with my identical twin brother. We recently had a hit with a short comedy parody film of the Lord of the Rings.

Q: What attracted you to the competition?

A: I have recently combined my love of science with writing and started being active in promoting science and technology. I participated in the Famelab competition in December 2012 pretending to be Henri Becquerel and presented for three minutes on his accidental discovery of radioactivity. After this, I saw the advertisement for a film competition and knew I wanted to try making my first science film –'The Promise of Engineering'.

Q: Tell us about your film and the inspiration behind it

A: I decided to do my film on sustainability – in my opinion the most important challenge on the list. I wanted it to be thought provoking and inspiring for both engineers and non engineers. I decided to make it less about the 'parts and components' and more about the people aspect. Engineering is not something that we pick up off the street; it is a very human creation. I felt that images, music and a personal dialogue would best address this subject.

Q: Do you think engineers need to communicate their goals and achievements better to the public?

A: Engineering and science in general always need to be communicated to the public better. While there is programming on science and engineering, there are many more ways to engage the public; songs, cartoons, theatre, film.

When I tell people I'm a physicist the first reaction is, "like the Big Bang theory?". I laugh and realise that while it paints scientists as massive geeks, 'The Big Bang Theory' has done an excellent job in making science appealing. I feel that in terms of media outreach, a web series format is a good way forward . The next generation are computer user heavy so that seems a good medium to engage them.

Q: What do you see as the most pressing challenge for the 21st century? How can engineers best address this?

A: This is a difficult question as I believe there are several key challenges but the one I feel most strongly about is affordable global energy generation. There are two main factors: one is the growing global population and the associated energy demand; the second is developing countries' increased need for energy. Non renewable sources could be used up at an alarming rate and this needs to be addressed.

I feel that a greater research focus is needed on renewable energy sources in conjunction with use of nuclear power. This is something that needs buy in from many of the world's nations. As renewable technologies are developed, they could be tied into projects that you wouldn't usually consider. For example in the UK: tidal defence barriers for major flood areas could be combined with tidal turbines to generate electric power. The recycling of these turbines could lead to valuable composite materials that could potentially be used in biological systems such as hip replacements.

I think a lot of barriers need to come down between the definitions of scientific fields. Working at Rolls-Royce has really made me realise that good ideas can be generated by a team of mixed expertise. This is an obvious statement, but one that we must remind ourselves of. The UK has an amazing network of research centres and a strong historical manufacturing industry. With the correct focus and of course political buy in, I'm sure there is much we can achieve together both nationally, and more importantly, globally.

US Short Film Competition winner
Katie Speights

Q: Tell us about yourself

A: I have lived in Texas my whole life. Upon graduation, I decided to study at The University of Texas in Austin, becoming a third generation Longhorn within my family. Currently, I am a second-year chemical engineering major and considering a minor in computer science. Although I honestly didn't know much about the major when I arrived, I now can't imagine doing anything else. In addition to my studies, I spend my time as a member at large in the Student Engineering Council, as an undergraduate research assistant in the department of environmental engineering, and as one of the NAE Grand Challenges Scholars. I am also looking forward to serving as a First-Year Interest Group Mentor next year, where I will help new engineering students with their adjustment to college life.

Q: What attracted you to the competition?

A: All of my life I have enjoyed making movies. Growing up, whenever there was an option to do a video project for school, I took it. However, as I've gotten older, there have been fewer chances to do this. So when I saw the opportunity to make a video describing one of the Grand Challenges, it immediately seemed like something that I would be interested in. This competition gave me the opportunity to educate people on something that I'm passionate about, the water energy nexus, in a creative and appealing way.

Q: Tell us about your film and the inspiration behind it

A: When I became involved in the NAE Grand Challenges Scholars Program at The University of Texas at Austin, I was really drawn to the access to clean water challenge. I was particularly interested in the relationship between water and energy. The water energy nexus represents two growing problems that are fundamentally connected and pervasive in almost every area of modern life. I was shocked (and thought others might be too) when I found out that we had already reached our United Nations Millennium Development Goal for clean water, and this made me decide to broaden the perspective of my video. I grew to recognize just how complex and interdisciplinary this problem truly is, and this realization shaped my video into something that I believe truly embodies the NAE Grand Challenges Scholars Program.

Q: Do you think engineers need to communicate their goals and achievements better to the public?

A: I believe that the communication between engineers and the public is absolutely essential to create lasting changes in society. Although engineers are responsible for the technology that moves the world forward, they are not responsible for fostering the implementation and adoption of this technology. Engineers have the knowledge and skills set to tackle some of the world's most challenging problems, but they must be effective communicators in order to educate the public on their ideas. Even the best idea, when poorly expressed, never becomes more than just an idea.

Q: What do you see as the most pressing challenge for the 21st century? How can engineers best address this?

A: I have already talked about this a lot, but I truly believe that the water energy nexus describes the world's largest problem. Access to clean water and sustainable energy has a huge effect on the quality of life of millions of people, and this will only become more relevant as populations grow and countries become more developed. I think that the first step in addressing this problem is recognizing its complexity and scope. In order to create lasting solutions, engineers will have to focus on creating community specific infrastructure rather than temporary solutions.

The US short film competition was kindly sponsored by:

IBM Genentech A Member of the Roche Group

>> Royal Academy of Engineering

As the UK's national academy for engineering, we bring together the most successful and talented engineers from across the engineering sectors for a shared purpose: to advance and promote excellence in engineering.

We provide analysis and policy support to promote the UK's role as a great place from which to do business. We take a lead on engineering education and we invest in the UK's world class research base to underpin innovation. We work to improve public awareness and understanding of engineering.

We are a national academy with a global outlook and use our international partnerships to ensure that the UK benefits from international networks, expertise and investment.

The Academy's work programmes are driven by four strategic challenges, each of which provides a key contribution to a strong and vibrant engineering sector and to the health and wealth of society:

- Drive faster and more balanced economic growth
- Foster better education and skills
- Lead the profession
- Promote engineering at the heart of society

>> National Academy of Engineering

Founded in 1964, the US National Academy of Engineering (NAE) is a private, independent, nonprofit institution that provides engineering leadership in service to the nation. The mission of the National Academy of Engineering is to advance the well-being of the nation by promoting a vibrant engineering profession and by marshalling the expertise and insights of eminent engineers to provide independent advice to the federal government on matters involving engineering and technology.

The NAE has more than 2,000 peer-elected members and foreign associates, senior professionals in business, academia, and government who are among the world's most accomplished engineers. They provide the leadership and expertise for numerous projects focused on the relationships between engineering, technology, and the quality of life.

The NAE is part of the National Academies, which also includes the National Academy of Sciences (NAS), the Institute of Medicine (IOM), and the National Research Council (NRC). The NAE operates under the same congressional act of incorporation that established the NAS, signed in 1863 by President Lincoln. Under this charter the NAE is directed "whenever called upon by any department or agency of the government, to investigate, examine, experiment, and report upon any subject of science or art."

>> Chinese Academy of Engineering

The Chinese Academy of Engineering (CAE) is a national and independent organisation composed of elected members of the highest calibre from the national community of engineering and technological sciences. Its missions are to initiate and conduct strategic studies, provide consultancy services for decision-making on key national issues in engineering and technological sciences, promote the development of engineering and technological sciences in China and devote itself to the benefit and welfare of society.

The main functions of the CAE are:

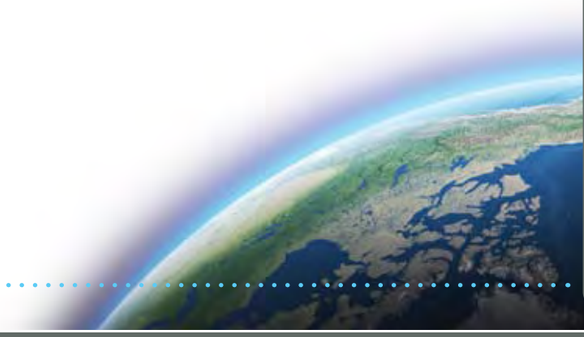
1) To bring into full play the combined expertise of its members in decision-making for national and regional economic development and social progress, as well as to undertake studies, consultancy and strategy evaluation for key projects, and to advise central and local governments on top-priority issues and orientation of key investments.

2) To organise studies on issues of orientation and frontiers of key engineering science and technology, promoting innovation capacity in industrial technology and improving management quality of science and engineering projects.

3) To carry out extensive academic exchanges and collaborations at home and abroad at all levels.

4) To popularise scientific knowledge and to contribute to the promotion of the standard of engineering science and technology and the quality of workforce in China.

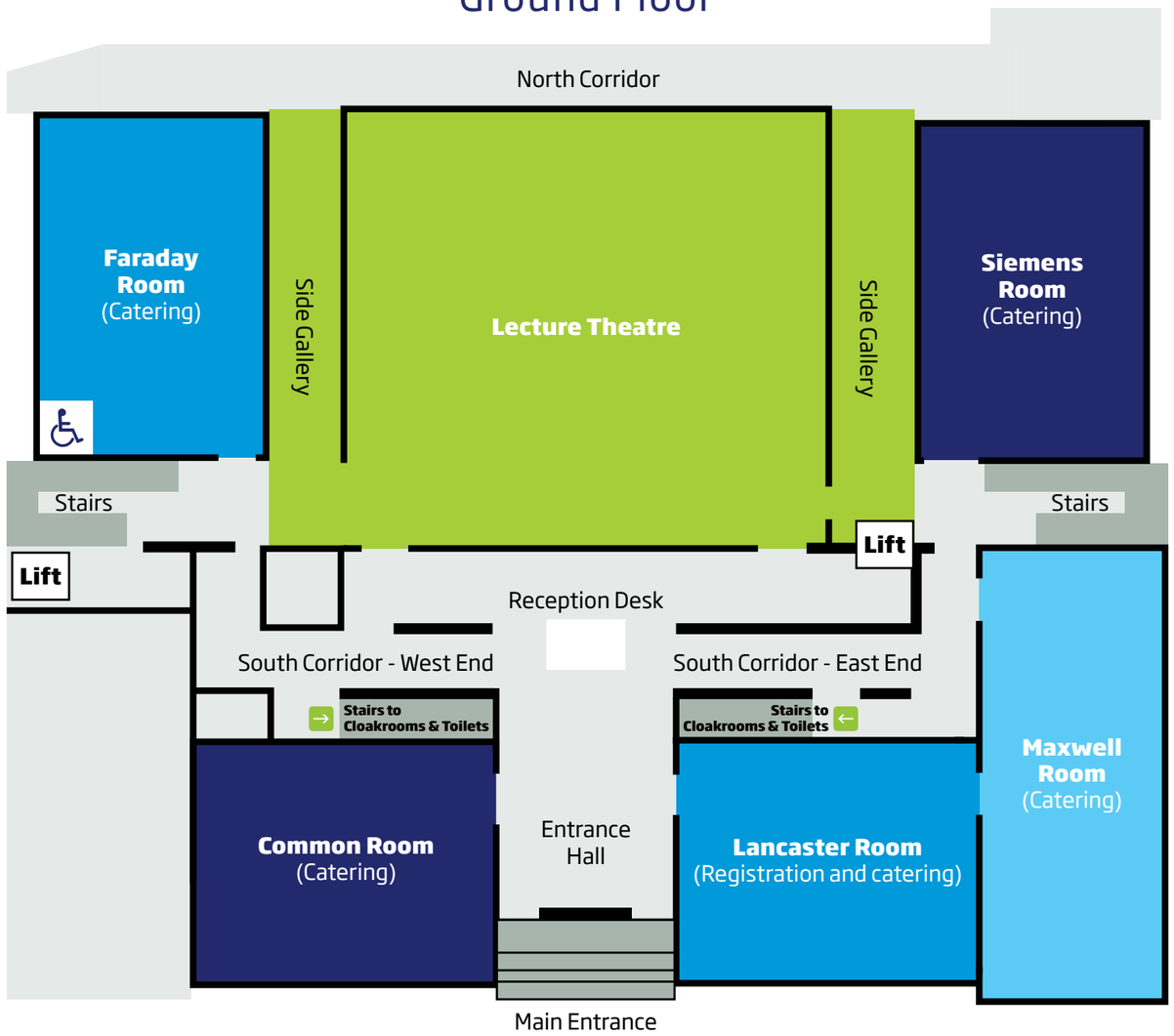
5) To safeguard science ethics, carry forward the scientific spirit, and vigorously promote the construction of socialist civilisation.



notes

venue map

Ground Floor



global grand challenges summit

Exploring collaborative approaches to tackling global grand challenges

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