



Science Policy Centre

2010 and beyond

CELEBRATE
350 YEARS



THE ROYAL SOCIETY

Foreword

“The truth is that promoting science isn’t just about providing resources – it’s about protecting free and open inquiry...It’s about listening to what our scientists have got to say, even when it’s inconvenient – especially when it’s inconvenient.”

President Barack Obama,
December 2008

The Royal Society has a long track record of providing scientific advice to policy makers. Its earliest report, on the state of Britain’s forests, was published in 1664.



Today, scientific advice to underpin policy is more important than ever before. From neuroscience to nanotechnology, food security to climate change, the questions being asked of scientists by policy makers, the media and the public continue to multiply. Many of the issues are global in nature, and require international collaboration, not just amongst policy makers, but also between scientists.

In the run-up to its 350th Anniversary in 2010, the Royal Society has established a Science Policy Centre in order to strengthen the independent voice of science in UK, European and international policy. We want to champion the contribution that science and innovation can make to economic prosperity, quality of life and environmental sustainability, and we also want the Royal Society to be a hub for debate about science, society and public policy.

As we celebrate the vision of our founders, the creation of the Science Policy Centre reflects our ongoing commitment to rational inquiry and evidence as the basis for good decision making. The Royal Society has flourished for three and a half centuries, but its work is far from done.

A handwritten signature in black ink that reads "John Krebs". The signature is fluid and cursive.

Lord Krebs of Wytham FRS
*Chairman, Royal Society
Science Policy Advisory Group*

For full membership of our Advisory Group, please see royalsociety.org/About-the-Science-Policy-Centre

How we work

The Royal Society's science policy work is based on the recognition that:

- An expanding range of critical areas of public policy have scientific aspects;
- Sound policies are more likely if decision makers have access to expert, independent scientific advice;
- A modern national academy should play a prominent role in monitoring the health of the UK and international science base, and assembling evidence to support investment.

Each year, we publish several **in-depth reports**, produced by **working groups** of Royal Society Fellows and other experts, who analyse the scientific evidence related to a topical issue. But we undertake many other types of activity, including **conferences and seminars, short statements, media work, consultation responses and briefings for policy makers**. We organise regular **PolicyLab** meetings, which bring together scientists, policy makers and other thinkers to debate emerging issues in science policy. And we represent the UK in **international networks** such as the **InterAcademy Panel on International Issues (IAP)**.

Who we work with

- Our 1,400 Fellows and 315 University Research Fellows provide a unique source of scientific expertise, which informs all of our policy activities. Fellows and other experts, including economists and social scientists, participate in working groups, and the Council of the Royal Society reviews our major reports.
- Our Science Policy Advisory Group, chaired by Lord Krebs, is responsible for the overall direction of our policy work, and contributes to horizon scanning, scoping new projects and sharpening our impact.
- Our international partners include science academies across Europe, US, China, India and beyond; research and policy organisations; charitable foundations and networks like the International Council for Science (ICSU) and the European Academies Science Advisory Council (EASAC).
- Our spheres of influence include decision makers in Westminster and Whitehall; business leaders; research funders and bodies such as the European Commission, OECD, World Bank and UN agencies.

Keeping in touch

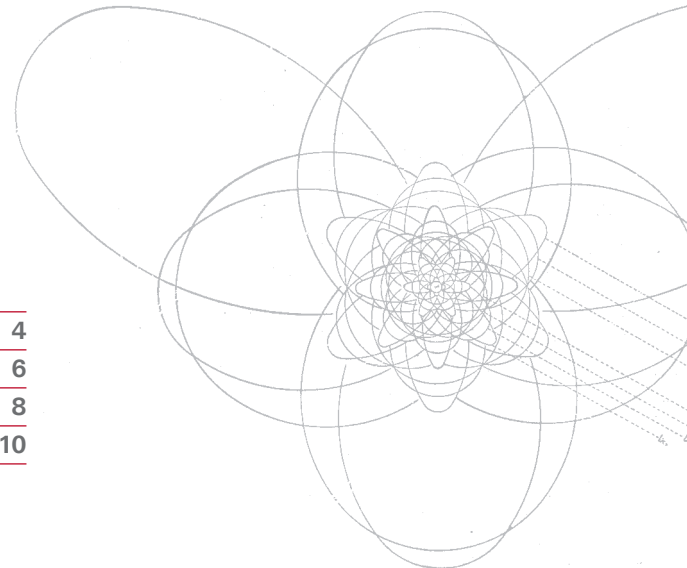
If you would like to receive our monthly e-newsletter, or notification of forthcoming events, please email us at

science.policy@royalsociety.org

Flagship themes

The Science Policy Centre organises its work under four themes:

Sustainability	4
Diplomacy	6
Innovation	8
Governance	10



Sustainability

'How can we feed 9 billion people equitably, healthily and sustainably? Provide enough water and energy for a growing population coming out of poverty? And all this whilst mitigating and adapting to climate change? The Royal Society is helping to provide solutions through its work on food-crop production, ocean acidification and geoengineering.'

Professor John Beddington CMG FRS,
Chief Scientific Adviser to HM Government

Climate change, energy and food security, biodiversity, poverty and population growth will shape the coming century. They will alter how we live, the balance of risks that we face, and the ways that we govern a more interdependent world. Tackling these challenges will require the best available science: to measure and predict impacts; to identify solutions; and to evaluate options and pathways for adaptation.

Using science to inform debates over sustainability has long been a priority of the Royal Society's policy work. Recent highlights include:

Food security

Our report '*Reaping the benefits: science and the sustainable intensification of global agriculture*' was published in October 2009. It assesses the contribution that next-generation biological approaches could make to global food production over the next thirty years. The Daily Telegraph described it as "the most comprehensive report on the future of agriculture in a generation".

Energy

Our influential 2008 study of '*Sustainable biofuels*', was followed by a meeting and report on '*Towards a low-carbon future*' and a co-hosted international workshop on '*Carbon dioxide capture and storage*'. We have also provided ongoing advice to the UK government on developing its strategy for the stockpile of separated plutonium.

Ocean acidification

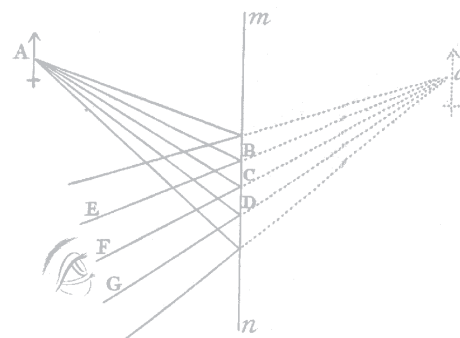
Increases in atmospheric carbon dioxide are resulting in ocean acidification. We first highlighted this issue in a report in 2005 and again in June 2009 in an IAP statement, with the support of 70 of the world's science academics. This statement called for ocean acidification to be given greater emphasis in the agenda of the UN climate negotiations in Copenhagen in December 2009.

Biodiversity

As a contribution to the International Year of Biodiversity, in January 2010, we will host a two-day IAP conference on ecosystem services and biodiversity, to be attended by experts and representatives of around 100 of the world's science academies.

Health

We work extensively on emerging issues in human and animal health. Recent projects have tackled pandemic influenza, antibacterial resistance and the need for an integrated approach to infectious diseases. We have also been involved in briefing MPs and policy makers on the importance of stem cell and embryo research.



'There is little in the way of public discussion on geoengineering in the US, but it appears that is beginning to change...I think it is fair to say that the Royal Society report is now the definitive authoritative document on the matter'

Christopher King, Staff Director,
U.S. House of Representatives Committee
on Science & Technology

Case study:

Geoengineering the climate

Until recently, geoengineering – deliberate large-scale intervention in the Earth's climate system – was decidedly taboo in discussions of climate change. There were concerns that the prospect of a techno-fix might encourage governments to duck hard choices around mitigation or adaptation. But over the past few years, the intensity of speculation has increased, to the extent that the Royal Society felt it was important to take a rigorous look at the feasibility and uncertainties of the various proposed techniques.

Under the chairmanship of Professor John Shepherd FRS of Southampton University, we assembled a group of twelve experts, drawn from environmental science, oceanography, engineering, economics, law and social science. The group spent a year weighing the evidence, and in September 2009 published their report. This aims to do three things:

First, it acts as a corrective to the more excitable cheerleaders for geoengineering, who present it as an alternative to the current policy focus on mitigation. Geoengineering may hold longer-term potential and does merit more research, but it offers no quick-fix solutions that should distract policy makers from working toward a reduction of at least 50 percent in carbon dioxide (CO₂) emissions by 2050.

Second, the report brings greater clarity to the debate by defining and comparing the two basic classes of geoengineering methods: carbon dioxide removal (CDR) techniques that remove CO₂ from the atmosphere and solar radiation management (SRM) techniques that reflect a small percentage of the sun's light and heat back into space.



Third, the report looks beyond the science to highlight a broader set of questions that need to be answered before geoengineering can proceed. The mix of factors at play in this debate is complex and combustible, and it is in everyone's interests that any moves toward geoengineering research, let alone implementation, enjoy the legitimacy that comes from robust frameworks of governance, accountability and public engagement.

Of course, the real test will be how the geoengineering debate plays out from here. The Royal Society intends to remain involved in these debates by working in partnership with other science academies and international bodies to create protocols for research and governance.

Diplomacy

Scientists and diplomats don't make for obvious bedfellows. While science is in the business of uncovering truth, Sir Henry Wotton, the 17th century diplomat, famously defined an ambassador as *'an honest man sent to lie abroad for the good of his country'*. But many aspects of foreign policy have scientific components. Science can act as a source of 'soft power' by improving a country's influence on the international stage. And the networks of cooperation that underpin science are ideally placed to broker solutions to global problems.

The Royal Society works with a broad range of international partners to strengthen the contribution of science to security, diplomacy and development.

Global science report

In November 2010, we will publish the first in an annual series of *'Global science reports'*, which will aim to make sense of where and how science is being done around the world. The first report, produced in partnership with Elsevier, will be launched at the new Kavli Royal Society International Centre for the Advancement of Science.

Science diplomacy

In June 2009, together with the American Association for the Advancement of Science, we organised a conference on *'New frontiers in science diplomacy'*, at which 200 participants from 18 countries explored the changing relationship between science and foreign policy in tackling issues such as nuclear disarmament; rebuilding trust with the Islamic world; and the governance of international spaces, including Antarctica and the Arctic.

'The Royal Society has a long history of using science to rise above military conflict and political and cultural differences. My post was instituted in 1723, nearly 60 years before the British Government appointed its first Secretary of State for Foreign Affairs...'

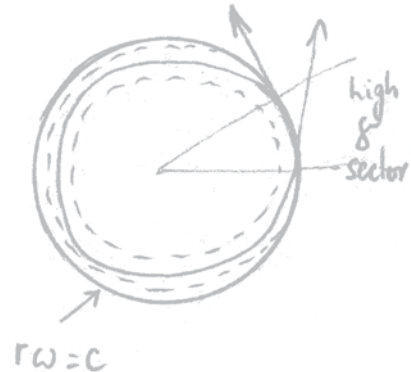
Professor Lorna Casselton FRS, Foreign Secretary,
The Royal Society

Alliances of academics

Through membership of the InterAcademy Panel (IAP) and the European Academics Science Advisory Council (EASAC), we work with our sister academics to bring scientific perspectives to bear on critical global issues. In 2009, the IAP produced joint statements on ocean acidification and deforestation, while EASAC published reports on tuberculosis, electricity grids and ecosystem services, which have been well received by the European Commission.

The atlas of Islamic world science and innovation

With gas-rich Qatar aiming to spend 2.8% of its GDP on research, and Saudi Arabia opening its US\$ 2.6 billion King Abdullah University for Science and Technology, the scientific ambitions of the Islamic world merit closer attention. Working with the Organisation of the Islamic Conference, British Council, *Nature*, the International Development Research Centre and others, we are undertaking a landmark study of science and innovation across fifteen countries in the Middle East, Africa and Asia, as well as exploring new opportunities for collaboration with the UK and Europe.



'Forty or so years after the signing of the Non Proliferation Treaty it is time that we are serious. One way we show this is by bold commitments, the other way...is by serious thought, serious debate and serious dialogue.'

Rt. Hon. David Miliband MP, Secretary of State for Foreign and Commonwealth Affairs, February 2009

Case study:

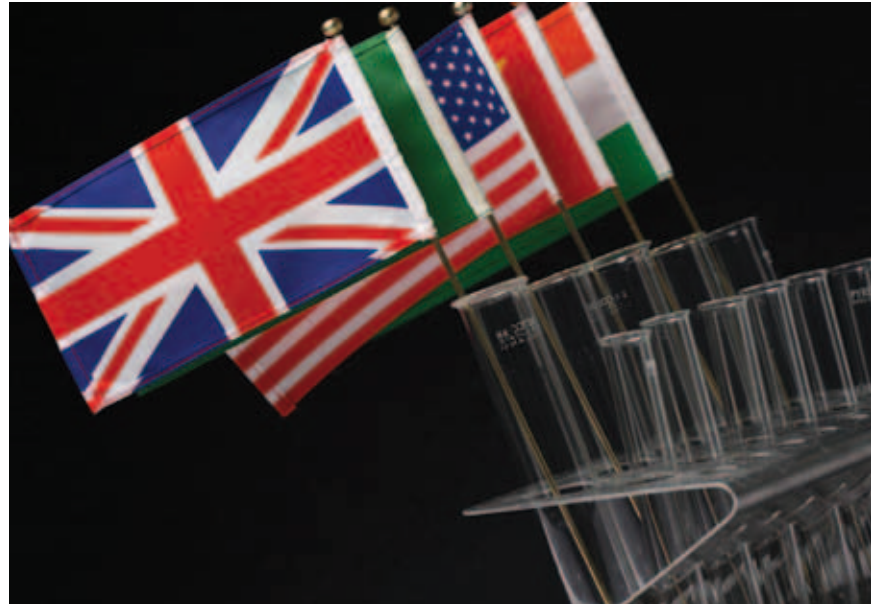
Nuclear disarmament and non-proliferation

Ahead of the 2010 Review Conference of the Nuclear Non-Proliferation Treaty (NPT), nuclear disarmament is once more high on the international political agenda. While many obstacles lie ahead, the recent momentum that the US and UK governments have brought to this process creates a once-in-a-generation opportunity.

There is an important science diplomacy message to communicate to the international community in the run up to the NPT Review Conference. Disarmament can be a slow process, and focusing now on its final stages may be premature. A practical first step is to establish the scientific basis of the verification regime that will be necessary to support future negotiations.

As a contribution to these efforts, the Royal Society is now undertaking policy work on nuclear disarmament, non-proliferation and the peaceful use of nuclear energy, corresponding to the three pillars of the Non-Proliferation Treaty. Working in partnership with the UK Foreign and Commonwealth Office, we are exploring the potential of science and technology to reduce the risks of nuclear proliferation, and to regulate the nuclear fuel cycle. This project draws on the Royal Society's earlier advice to the UK government on the management of its civil stockpile of separated plutonium.

We are also working with King's College London on a project to inform President Obama's April 2010 Nuclear Security Summit. This project will address the role of science and technology in improving global nuclear security, building on our 2008 report on innovative techniques to combat the illicit trafficking of nuclear and radiological materials.



Innovation

We can't predict the 21st century counterparts to quantum theory, the double helix or the computer, nor where the great innovators of the future will get their formative training and inspiration. But one thing seems certain: unless we get smarter, we'll get poorer. Our relative standing will sink unless some of the best ideas of the 21st century germinate and are exploited here in the UK. The pressures of an economic downturn, the pace of globalisation and the urgency of moving to a low-carbon economy, require policy makers to rethink established links between the creation of knowledge and long-term prosperity.

The Royal Society aims to enhance the contribution of science to innovation, and demonstrate how a vibrant research base creates value in many ways: through the supply of skilled individuals; through contributions to wealth creation and quality of life; or through simply discovering more about the world.

Innovation in services

In July 2009, we published our *'Hidden wealth'* report, which analyses the role of science, technology, engineering, and mathematics (STEM) in innovation across the UK's service sectors. Based on an 18-month study, chaired by Professor David Rhind CBE FRS, the report highlights quite how deeply STEM is embedded in services, which make up around three quarters of the UK economy. To further bolster this position, the report made recommendations to the Research Councils, Technology Strategy Board, Financial Services Authority and Bank of England.

'The Royal Society's *'Hidden Wealth'* report is a real piece of scholarship, an extremely well researched report, which is a call to arms for the future success of a major part of the UK economy.'

Professor Ian Diamond, Chief Executive,
Economic and Social Research Council

Higher education

There have long been concerns that the UK education system may not provide the quantity and quality of skilled people needed for the workforce. In *'A degree of concern?'* (2006) and *'A higher degree of concern?'* (2008), the Royal Society looked in detail at the supply of, and demand for, graduate and post-graduate scientists and engineers. These reports identify how UK STEM higher education can stay fit for purpose over the next decade. On an ongoing basis, we contribute actively to debates over higher education reform, research funding and the future of research assessment.

Corporate network

Our newly-established Corporate Network brings together senior figures from the worlds of business and science in an influential forum. Its members, including Shell, Pfizer and Elsevier, are encouraged to provide insights that can improve the business relevance of our policy projects (see royalsociety.org/corporate-network).



'We have to seize this opportunity to reshape our economy, based on science and innovation. British scientists and engineers led the industrial revolution and made the UK one of the world's great economic powers. Today our scientists remain among the best in the world. It is time we put their ideas more effectively to work.'

Sir Martin Taylor FRS, Chair,
'The fruits of curiosity' Advisory Group

Case study:

The fruits of curiosity: science, innovation and future sources of wealth

In April 2009, the Royal Society launched *'The fruits of curiosity'* project, to review the landscape for UK science and innovation policy and chart its future direction. The project will measure the different forms of value created by science, engineering and medicine for the economy and society. And it will consider the role that science will play in equipping Britain to meet the challenges of the next thirty years.

It takes place against the backdrop of an economic crisis which has prompted intense debate about the relative strengths and sustainability of the UK economy. In his Romanes Lecture on 27 February 2009, the Prime Minister argued that the recession may provide an opportunity to "rebalance" the economy, away from finance and towards more research-intensive, high-technology sectors.

'The fruits of curiosity' provides the Royal Society with an opportunity to articulate afresh the economic, social and cultural case for science in our 350th anniversary year. It is also timely to review these issues ahead of the next General Election and spending round, and to influence thinking about what lies beyond the current 10-year investment framework. We hope the study may have an impact on UK policy similar to that of the US National Academies' 2005 study *'Rising Above the Gathering Storm'*, which influenced many of the policies now being implemented by President Obama's administration.



'The fruits of curiosity' Advisory Group is chaired by Sir Martin Taylor FRS, until recently Vice-President of the Royal Society. Others on the group include: eight Fellows of the Royal Society; two leaders of high-tech, research-intensive companies; two former Ministers for Science; and leaders of organisations such as the Confederation of British Industry, the Wellcome Trust and the European Research Council.

Governance

The relationship between science and politics is sometimes uneasy. Negotiations can take place out of view - in the corridors of Whitehall or the workings of expert committees. Now and then, particular developments spark controversy or become condensation points for wider public concern. Whether it is the prospect of a new wave of nuclear power stations, advances at the frontiers of biotechnology, or research with 'dual-use' applications in warfare or terrorism, our capacity to innovate presents us with dilemmas as well as opportunities. We need to generate approaches to the governance of science that can learn from past mistakes, cope with uncertainty, and harness technological change for the common good.

The Royal Society has a prominent voice in debates about the relationship between science, government and society.

MPs and civil servants pairing scheme

Our MP-Scientist pairing scheme was set up in 2001 to help build bridges between politicians and the best researchers in the UK. It has since expanded to include civil servants. By linking scientists with policy makers, often from the same local area, the scheme enables beneficial, longstanding connections to be established.

'The Royal Society's expanding work in Africa is increasingly aimed at facilitating intelligent, evidence-based policy making that draws on the very best indigenous research expertise.'

Professor Mohamed Hassan, Executive Director, TWAS, The Academy of Sciences for the Developing World.

Capacity building in Africa

The science academies of Ghana, Tanzania and Ethiopia are the main focus of our capacity building programme, developed in partnership with Pfizer and the Network of African Science Academies (NASAC). We aim to strengthen the capacity of these academies to act as champions of science and provide locally grounded, evidence-based policy advice to their governments.

Biological risks

Assessing biological risks, and preventing the misuse of scientific research in biological weapons, is a longstanding area of our policy work. In 2009, we hosted an international workshop on biological risks, and subsequently published its conclusions.

Neuroethics

Rapid advances in neuroscience are raising a range of legal, ethical and governance questions. In 2010, we are launching a new programme of work to explore the policy implications of neuroscience for areas such as education, security and criminal justice.

Debating DNA

DNA fingerprinting, which enables the identification of an individual based on their genetic makeup, has changed the face of criminal investigations, but also raises ethical and civil liberty issues. As one of our monthly series of PolicyLab meetings, we invited Sir Alec Jeffreys FRS, who pioneered DNA fingerprinting, and Shami Chakrabarti, Director of Liberty, to debate these issues with an audience of scientists and policy makers.

'New technologies can offer many benefits but it is important to recognise that they may raise new challenges in safety, regulatory or ethical domains. Recognising this, the Royal Society has led the scientific community in undertaking effective public and stakeholder dialogue so that new technologies can be developed in a safe and socially desirable way.'

Dame Ann Dowling FRS,
Professor of Mechanical Engineering,
University of Cambridge

Case study:

Synthetic biology

Synthetic biology is a promising blend of science and engineering, which aims to construct novel biological entities and redesign existing ones. It is a new field, but one that has already stimulated substantial discussion over its potential to contribute to sustainable energy and improved healthcare.

These opportunities are accompanied by uncertainties and risks, as well as ethical and regulatory dilemmas, which need to be addressed on a global scale. To support this process, in July 2009 we held an international symposium on '*Opportunities and challenges in the emerging field of synthetic biology*' in partnership with the US National Academies and the Organisation for Economic Co-operation and Development (OECD). The conclusions of this meeting have helped to shape our plans for future work on the international governance of synthetic biology.

In 2010 and 2011, we will produce a comprehensive report on the range of governance options at national and international levels. We are also planning a three-country process, involving the science and engineering academies of the UK, USA and China. Through a series of international meetings, this process will explore the changing landscape for synthetic biology and design more robust frameworks for oversight, intellectual property and international cooperation.



Synthetic biology is nationally as well as internationally significant. Within the UK, the Royal Society hosts the Synthetic Biology Policy Coordination Group, which brings together government departments and agencies, civil society groups, learned societies, natural and social scientists to track and stimulate efforts to encourage the responsible development of the field.

The Royal Society

The Royal Society is a Fellowship of 1400 outstanding individuals from all areas of science and from engineering and medicine, who form a global scientific network of the highest calibre. The Fellowship is supported by a permanent staff of over 130 with responsibility for the day-to-day management of the Society and its activities.

In our 350th anniversary year and beyond, we are working to achieve five strategic priorities:

- Invest in future scientific leaders and in innovation
- Influence policymaking with the best scientific advice
- Invigorate science and mathematics education
- Increase access to the best science internationally
- Inspire an interest in the joy, wonder and excitement of scientific discovery

For further information:

Dr James Wilsdon
Director, Science Policy Centre

The Royal Society
6-9 Carlton House Terrace
London SW1Y 5AG

T: +44 (0)20 7451 2550

F: +44 (0)20 7451 2692

E: science.policy@royalsociety.org

W: royalsociety.org/policy



Issued: November 2009 DES1601

Founded in 1660, the Royal Society is the independent scientific academy of the UK, dedicated to promoting excellence in science

Registered Charity No 207043

The cover image is taken from the 1776 edition of *'Sylva, Or A Discourse Of Forest-Trees And The Propagation Of Timber In His Majesties Dominions'*, by John Evelyn FRS. The image shows part of the Scotch Fir tree. The first edition of 'Sylva' was published by the Royal Society in 1664. It was written to encourage landowners to plant trees in order to provide timber for England's burgeoning navy, and in that respect represents the first ever science policy document published by the Society.



The Royal Society
Science Policy Centre
6-9 Carlton House Terrace
London SW1Y 5AG
United Kingdom

If you are interested in finding out more about the Royal Society's Science Policy Centre, we would be keen to hear from you. Just fill in your details, affix a postage stamp and send the card back to us.

Name

Job Title

Organisation

Address

Postcode

Phone

Email*

Please tick at least one:

- I would like to receive monthly email updates on the Science Policy Centre's activities
- I would like to receive email invitations to PolicyLabs and other policy-related events at the Society
- I would like to receive email alerts when a new Science Policy Centre publication is produced

I am interested in the following areas of the Science Policy Centre's work

- Sustainability
- Diplomacy
- Innovation
- Governance
- All

Alternatively you can email us at science.policy@royalsociety.org

*We send all of our information out electronically so please ensure that you provide us with the correct email address.