



Research Fund



Because science is at the heart of societal progress

Activity Report 2023

About the AXA Research Fund

The AXA Research Fund was launched in 2008 to better address the major risks faced by our planet through science. AXA has committed a total of €256M to scientific funding and supported over 720 research projects in the areas of health, climate and environment, and socio-economics. The AXA Research Fund's mission is to support transformative scientific research and to help inform science-based decision-making in both the public and private sectors.



A new LinkedIn page

In July 2023, the AXA Research Fund kicked off its own LinkedIn page: @AXA Research Fund. Aimed at connecting our audiences of academics, experts, decision-makers, and curious minds, the channel displays news about funded research projects, funding activities, and broader updates from the science philanthropy scene, as well as our academic partners.



Key Figures*

€256M

committed to
research since 2008

724

research projects
supported

340+

leading academic
institutional partners

43%

women-led
projects

*as of 31.12.2023



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Ulrike Decoene

Group Chief
Communications, Brand
and Sustainability Officer

Acting for human progress

In 2023, the AXA Research Fund entered its third mandate, marking a remarkable 16-year journey of advancing human progress.

Over this time, the Fund has achieved numerous tangible successes in aiding our societies in managing risks and **protecting what matters**, with the backing of robust scientific facts.

This mandate renewal coincided with a change at the head of the AXA Research Fund. I would like to express my sincere gratitude to Marie Bogataj for her 5 years of dedicated leadership, and extend a warm welcome to Julia d'Astorg, who joined as the new Head of the Fund in November 2023.

Additionally, Prof. Debra Roberts accepted to oversee the independent selection process and support the development of the Fund's new strategy.

In an era where **misinformation-related risks** have reached unprecedented levels and **multiple crises** are rapidly evolving worldwide, we firmly believe that the new direction of the Fund will play a pivotal role in fortifying and **adapting our societies**. It is our conviction that this shift will help us face the future with greater confidence, in full line with, and in support of, AXA's strategy.



Julia d'Astorg
Head of the
AXA Research Fund

Expanding our horizons while honing our influence

What an inspiring time to join the AXA Research Fund!

I would like to express my deepest gratitude to the former heads of the AXA Research Fund whose vision and dedication have been instrumental in shaping the Fund's success over the past 15 years. As we embark on bringing the new strategy of the Fund to life, it is essential to reflect on the Fund's impact.

The assessment of the Fund's last mandate's influence on research, scientists, and society was undeniably impressive. It served to underscore the excellence of the fellows we support and demonstrated how our unique independence in funding enhances our research capabilities. Furthermore, our outreach initiatives effectively translate scientific findings into impactful decisions and actions.

In 2023, the Fund pursued **its core, iconic role** of funding and disseminating independent, innovative science. This involved supporting scientists at all stages of their career: fostering transdisciplinary communities of young scientists through the AXA PostDoc Fellowships, with 8 new projects selected in the field of renewable energy; helping ambitious science programs develop in the long run with AXA Chairs, with the selection of 2 outstanding female chair holders working on the crucial issues of water quality and women's health; and leveraging the transformative potential of emerging talents through the AXA Awards.

Over the past year, the Fund has also strengthened its capacity to deliver short-term impact through **strategic partnerships**, to help collectively **face the challenges of our times** with the most relevant organizations in the field, based on AXA's observed research needs to address key societal challenges. Examples include a new observatory on dengue outbreaks related to climate change, a new research hub focusing on systemic risks, and a joint partnership on cyber risk, among others.

In the area of dissemination, as in funding, the Fund has sought to move toward higher impact and outreach to the user through dedicated assets for decisionmakers and practitioners, with the launch of **MasterScience masterclasses**, supported by targeted campaigns, and the launch of a new AXA Research Fund LinkedIn channel to connect scientists and experts.

Broadening our role by leveraging larger **philanthropy networks** is the next step for the Fund, as we strive to **foster synergies and catalyze new capabilities**.

We invite you to immerse yourself in this eventful year of accomplishments and explore some of our compelling examples and testimonials.

Enjoy reading!



Prof. Debra Roberts

President of the
AXA Research Fund
Scientific Board

Helping create a better future with innovative science

The Nigerian author Chinua Achebe wrote “If you only hear one side of the story, you have no understanding at all.” It is a reminder that we need to **consider every aspect of a story if we are to fully understand it**. The story of humanity in the 21st Century is one dominated by the **polycrisis** of climate change, biodiversity loss, pollution, poverty, and pandemics. We live in an era of multiple and interconnected risks that are undermining our present and future options for sustainable development for all.

Tackling these complex challenges and moving our global society towards a **more just and equitable future** relies on evidence and knowledge drawn from across the physical, natural, and social sciences. This is why the work of the AXA Research Fund is so critical. The Fund enables independent and innovative research that helps society understand the different challenges and opportunities we face. The Fund allows both well-established scientists and early career researchers the freedom to ask the big and game-changing questions of the present and the future and provides them with the resources to potentially change the world through the knowledge they create. Every Chair and Post-doctoral awardee I have spoken with has highlighted how transformative the support of the AXA Research Fund has been for their career and research.

It was therefore enormously encouraging to see the mandate of the Fund renewed again in 2023. I was also honoured to accept the responsibility of chairing the Scientific Board of the Fund at the start of this new mandate. The Scientific Board is responsible for ensuring the transparency and the integrity of the selection process for every research project awarded support across the key focus areas of the Fund, be they **socio-economic, health, environment, or climate change**. The Scientific Board members take this responsibility very seriously as is witnessed by the quality of the 2 Chairs and 7 Post-doctoral fellows selected during 2023. The research these scientists will undertake will allow us to rise to Chinua Achebe's challenge of looking deeply into the problems and opportunities they are investigating, and help society identify responses to immediate challenges as well as galvanise actions that create a better future for human and natural communities across the planet.



**Entering
a new 5-year
mandate
building upon
our previous
achievements**

Shaping the future with a new mandate and a new President for our Scientific Board

The AXA Research Fund functions on a five-year mandate with one mission at its heart: supporting transformative and excellent science. **The current mandate was launched in January 2023**, and is focused on further strengthening the transdisciplinary exploration of emerging risks, consolidating links between academic experts, industry and the public sector around major societal issues for informed decision-making, and implementing innovative formats for the dissemination of scientific knowledge for the benefit of decision-makers and the public.

The AXA Research Fund was also honored to appoint its **new President of the Scientific Board, Prof. Debra Roberts**, succeeding Prof. Thomas Kirkwood. With 30 years in local government, Prof. Roberts has been responsible for a diverse range of portfolios, including sustainable development, environmental management, biodiversity planning and management, climate change adaptation, and resilience. In 2015, Prof. Roberts was elected Co-Chair of Working Group II (Impacts, Adaptation, and Vulnerability) of the Intergovernmental Panel on Climate Change (IPCC) for the sixth assessment cycle (2015-2023). In 2019, she was included in a list of the World's 100 Most Influential People in Climate Policy.





Assessing the impact of our previous mandate

In 2023, we conducted a thorough assessment of the value creation of our endeavors over the Fund's third mandate (2018-2022). The analysis comprehensively reviewed the influence of the AXA Research Fund's support of academic research, the granted scientists, the broader scientific community, and society as a whole. Drawing from bibliometric data analysis and interviews with scientists and experts, the report provided a snapshot of our funding and dissemination activities and highlighted tangible stories from outstanding researchers.

With its steady support for science, the Fund has yielded impressive results over its third mandate:

A balanced portfolio of supported research

135 research projects were funded, fairly dispersed among climate and environment, health, and socio-economic subjects, reflecting the diversity of the challenges of our times that we strive to address.

The Fund supported researchers throughout their careers thanks to a variety of funding schemes, from early career with PostDoc Fellowships to senior scientists with AXA Chairs.

Volume, quality, and accessibility of the produced science were substantial

The 135 funded research projects over the last mandate led to an impressive output of 1,317 research publications, including 976 research articles, with 322 published in top 10% journals.

The research outcomes address diverse and critical areas such as biodiversity, climate change adaptation, chronic illness, healthcare access, social inclusion, and mental health, just to name a few.

“

The support I received from AXA catapulted my career. The media training we had at the beginning introduced me to media engagement and social media work, and so I now do a lot of work on social media, raising awareness on nutrition issues tailored towards Africans in the UK and beyond. I have also developed skills in the methodologies I used such as photovoice and community readiness model, which I will then be able to use to support postgraduate students in their projects. I am currently co-supervising a PhD student using these methodologies.



Dr. Hibbah Osei-Kwasi,
Postdoc (2019) at
University of Sheffield,
United-Kingdom

”



The AXA Research Fund releases its Impact Report (2018-2022)

The funded work was highly cited (16,390 citations) with 81 papers being in the top 1% of highly cited documents (6.1%). These outstanding citation metrics demonstrate the high quality of AXA Research Fund project outcomes and the attention they are receiving from the scientific community.

Furthermore, 69% of publications were open access, allowing increased exposure and access for both scientific and expert communities.

A diverse and successful community of scientists on the rise

The 124 scientists supported over the last mandate represented 34 nationalities and conducted their research in 24 different countries.

The recipients of our support over the last 5 years have witnessed a remarkable ripple effect in terms of grants, awards, and honors: over €270M in subsequent funding was secured following the Fund's investment of €30M among 50 grantees. And no fewer than 65 awards and prizes were also received by our last mandate's grantees.

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The AXA Research Fund is an exemplary model for research support. It gives researchers the freedom to fully unleash their potential to carry out the research. In my case, I have been able to conduct highly applicable research in biomedical imaging, which is now used worldwide. I have also conducted upstream research into wave behavior, all of which, I believe, will be the seeds of new future applications. This has been possible, of course, thanks to the financial support of the Fund, but also to the precious philosophy of the Fund, based on steady trust and support.



Prof. Emmanuel Fort,
AXA Chair (2012),
Outreach (2022)
ESPCI - Paris PSL
(The City of Paris Industrial
Physics and Chemistry
Higher Educational Institution),
France

”



Impact summary for the last five years

(2018-2022 mandate)

Research

Scope

135 funded research projects across

107 academic institutions

Publications

1,3K+ research documents

Citations

15K+ citations, with

77% of documents cited and an average of

12 citations per document

Researcher

People

124 funded researchers

Honors

64 academic awards and

€270M in subsequent funding from external organizations

Diversity

34 nationalities

Career development

64 career opportunities including

22 tenured professorships

Scientific Community

Hiring

250 additional positions created

Gender parity

50% of funded projects led by women

Global outreach

26 countries across

5 continents

cc.3/4 research documents resulting from international collaborations

Society

Media

6,5K+ news appearances

445K engagements

20bn potential reaches

Appearance in “The Conversation”

39 articles

978K audience

The AXA Research Fund channels

YouTube

5M views

50K hours played

1,4K subscribers

X (ex. Twitter)

7K+ tweets

16K interactions

126M potential audience

+23% followers

Technology transfer

7 patents published

14 startups and spinoffs created



**Supporting
best-in-class
academic
research
to help protect
what matters**

Iconic funding

In 2023, the Fund pursued its historic mission to support independent, innovative science on the key societal challenges of our times. This has been achieved notably through **our two iconic funding schemes: the AXA Chairs and the AXA Post-doctoral Fellowships.**

The **AXA Chairs** help ambitious research programs develop in the long run, with the selection of two outstanding projects led by brilliant female chair holders dedicated to the crucial issues of water quality and women's health. A new Chair campaign was launched at the end of the year.



Prof. Ann Van Griensven

AXA Chair on Water Quality and Global Change at Vrije Universiteit Brussel

Globally, 3 billion people are at health risk due to scarce data on water quality, according to UNEP.

Long-term climate change, extreme events, and seasonal variations in weather have profound impacts on the water quality of rivers, lakes, and reservoirs, which in turn threatens the environment, economies, and global

health. The project led by Prof. Ann Van Griensven will deliver the first high-resolution global freshwater quality model, which will provide datasets and maps of present and future hotspots of water quality problems on a global scale. The collected data will be fed into models which will help governments better manage their policies in this area.



Prof. Inés Pineda Torra

AXA Chair in Cardiovascular Risk in Women During Menopause in Seville

Cardiovascular disease is the leading cause of death among women worldwide.

The goal of Prof. Inés Pineda Torra with this project is to more effectively profile cardiovascular risk in women, which increases with menopause. She aims to define how hormonal changes and circulating fats that

appear with menopause influence the molecular mechanisms that explain this risk. Defining the molecular basis of the increased cardiovascular risk in women with menopause will help prevent it, through the identification of new biomarkers to improve current prediction and diagnosis tools, as well as possible therapeutic targets.

The **AXA Post-doctoral Fellowship** aim to foster transdisciplinary communities of young scientists, with seven new projects selected in the field of renewable energy in 2023:

7 New Post-doctoral Fellows on Renewable Energies

In December 2023, the Scientific Board of the AXA Research Fund selected seven innovative research projects that will help address the environmental and socio-economic challenges facing renewable energies to ensure a fair, sustainable, and inclusive transition.

The post-doctoral fellows from leading universities in Spain, the United Kingdom, Australia, and France will study the impact of renewable energy on biodiversity, rare-earth-free sources of renewable energy, geothermal energy from young volcanic areas, solar agriculture, hydrogen production from agroindustry waste, sustainable recycling of critical commercial waste, and ensuring a sustainable and fair transition for vulnerable populations.



Dr. Aida María Díez Sarabia,
University of Vigo,
Spain

**Green-Hydrogen from
Agroindustry Waste**



Dr. Chloé Dindault,
University of Bordeaux,
France

**Agrioltaics: Renewable
Energy and Increased
Crop Yields**



Dr. Hansheng Chen,
University of Sydney,
Australia

**Rare-Earth-Free Magnets
Addressing the Critical
Minerals Supply Challenges**



Dr. Ekeabino Momoh,
University of Toulouse III
Paul Sabatier, France

**Exploring Geothermal
Energy in Young European
Volcanic Areas**



Dr. Haytham Hussein,
University of Aberdeen,
United Kingdom

**Regeneration of Critical and
Rare Elements from Batteries
and Electronical Devices via
Electrochemical Recycling**



Dr. Evelyn Uribe,
University of Glasgow,
United Kingdom

**Impact of Renewable
Energy Transition for
Indigenous Communities
in Chile**



Dr. Henry Häkkinen,
Zoological Society of London
(University College London),
United Kingdom

**Assessing Onshore Wind
Farm Impacts on Ecosystem
Functions**

Joint funding schemes

Additionally, within the Fund's framework of philanthropy, in 2023 we continued to **grant research in collaboration with AXA's business entities**, based on their expert recommendations regarding research gaps on major global risks.

Three Joint Research Initiatives were approved, allowing independent academic teams to join forces and resources with teams of AXA experts to accelerate scientific knowledge on wildfires, cyclones, and the ground impact of space weather.



Understanding wildfire risk in Chile

The Joint Research Initiative led by the GEOFOREST Research group at the University of Zaragoza in collaboration with the AXA Climate Team aims to assess the future environmental risks posed by wildfires in Chile. The research team will focus on developing and improving quantitative methods to model wildfire risk in Chile, considering the influence of climate change on the frequency, intensity, and behavior of wildfires. The results of this research effort will contribute to improving predictions of the impact of wildfires in Chile, enabling policymakers, insurers, and the business community to take proactive measures in mitigating their effects on society and the economy, with the potential to benefit other regions facing similar wildfire challenges around the world.

Extratropical cyclones and high-impact weather in Europe

Extratropical cyclones (ETCs) are a major hazard for Europe as they cause most of the windstorms and floods in the mid-latitudes, resulting in high economic and social costs. The Joint Research Initiative led by the Institute for Atmospheric and Climate Science (IAC) at ETH Zurich with AXA Group Risk Management aims to provide a comprehensive approach that quantifies and evaluates the future environmental risks posed by ETCs in Europe. The research results will contribute to better predictions of the impact of ETCs in Europe and will enable policymakers and insurers to take proactive measures in mitigating their effects on society and the economy.



Space weather: Probability and severity of impacts on the ground



Space weather poses real risks to technological systems such as power grids, telecommunications, and satellites. Their economical and social consequences could be astronomical. The Joint Research Initiative between the Grenoble University Space Center and AXA XL's Space Industry Division, represented by Denis Bousquet, will investigate the various risks associated with space weather, assess the likelihood of their occurrence, and evaluate their potential impact on infrastructure. The project will specifically focus on effects on the ground and delve into the economic and social impacts of these risks, with the goal of producing informative materials for relevant stakeholders and guidance for the insurance sector to better prepare for and respond to space weather-related risks.

Two Awards were granted jointly with AXA entities, on the global climate-water nexus and on the impact of climate on vulnerable populations, with AXA XL and AXA Investment Managers (AXA IM) respectively.



Dr. Petra Holden's research on nature-based solutions

Dr. Holden, researcher at the African Climate and Development Initiative at the University of Cape Town, has won the AXA Award on Climate Water Nexus, jointly launched between AXA XL and the AXA Research Fund. The prize will support her research around nature-based solutions for an equitable, biodiverse, and sustainable climate future.

“

By scaling nature-based solutions, governments can contribute to climate, biodiversity, and water goals.

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Dr. Petra Holden,
AXA XL Award on Climate Water Nexus - University of Cape Town, South Africa



Dr. Anika N. Haque's research on urban climate change resilience in the Global South

The 2023 edition of the AXA IM Research Award jointly granted with the AXA Research Fund rewarded the work of Dr. Anika N. Haque from the University of York. It recognized her work on the exacerbated vulnerability of populations in urbanized and disadvantaged areas of the Global South to the consequences of climate change, and on the inclusion of women in the policies and adaptation strategies designed to address them.

“

The award's significance lies in its potential to raise awareness, inform decision and policy making, encourage collaboration, and allocate resources to address climate change vulnerabilities in urban areas.

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Dr. Anika N. Haque,
AXA IM Award on Social Dimensions of Climate Change University of York, United Kingdom

**Collectively
facing the
challenges
of our times
through strategic
partnerships**

In addition to its historical activity of funding science via calls for projects for Post-doctoral Fellowships or AXA Chairs, or granting, jointly with AXA entities, AXA Awards, or Joint Research initiatives, the AXA Research Fund has continued to expand its strategic partnerships in 2023. These partnerships support research around the most pressing issues in an agile manner and allow us to champion innovative, cutting-edge research collaboratively with world-leading academic institutions, foundations and industry partners. In a world of polycrises, these partnerships are ever more important, as they help to foster resilience by bridging science with private and public policy-making.

Previously engaged and ongoing partnerships have included research labs dedicated to improving gender equality at Sciences Po Paris & Bocconi University, the investigation of a successful energy transition at the Paris School of Economics, and with the Center for Economic Policy Research on various questions of socio-economic risks related to the climate transition. In 2023, 4 major new partnerships were initiated:

AXA XL and the AXA Research Fund join the Cambridge Systemic Risks Hub

The research hub created by the Cambridge Centre for Risk Studies (CCRS) aims to mitigate systemic risks such as climate change, pandemics, cyber threats, geopolitical change, and financial crises.

To gain a deeper understanding of the interconnected nature of systemic risks, it explores the drivers, implications, and potential solutions to inform and enable the insurance industry to better respond to current and future threats. The hub fosters private-public collaboration to encourage sharing of expertise to develop new risk transfer products and advisory services. AXA XL and the AXA Research Fund will focus on climate transition risk as their contribution to the initiative. The climate transition is expected to have significant global implications for geopolitics, technology, social cohesion, and business development, affecting all countries and all sectors of the economy



A biodiversity and ecosystem services (BES) scenarios modelling challenge launched with Swiss Re Institute, EY, and WWF



Biodiversity and ecosystem services (BES) play a foundational role in the resilience of our societies, economies, and quality of life. More than half of global GDP moderately or highly depends on biodiversity and ecosystem services. If societies continue current production and consumption patterns, IPBES scientists expect that 30 to 50 percent of all species may be lost by the middle of the 21st century. A joint call with AXA Research Fund, WWF, Swiss Re Institute and as a service contributor to Swiss Re, EY, was launched to improve the measuring, tracking, reporting, and forecasting of expected BES developments, as a prerequisite for efficient action. Five institutions were identified as winners and endowed with USD 100,000 each to support their research. They will address: creating nature-positive scenarios for landscape development in Switzerland and Peru; establishing a framework for managing natural catastrophe risks using nature-based solutions; supporting communities in Central Belize to adapt to changing climate patterns and safeguard livelihoods; examining the current and future status of biodiversity and ecosystem services in global mountain, island, and delta systems; and developing analyses to understand the implications of climate and land use change in Europe.

A new observatory on dengue outbreaks at LSHTM



Vector-borne diseases —human illnesses caused by parasites, viruses, and bacteria transmitted by living organisms such as mosquitoes, ticks, and fleas —account for more than 17% of infectious diseases and around 700,000 deaths every year.

AXA UK and the AXA Research Fund have joined forces with the London School of Hygiene & Tropical Medicine (LSHTM) on a project to develop a global observatory for vector-borne disease outbreaks. This includes an outbreak forecasting system that will give a direct and immediate measurement of climate and climate change's impact on the risk of dengue outbreaks and a wide range of other diseases. Using data and climate information, the lab will develop new forecasting systems to predict outbreaks up to three months in advance, helping better plan response.

A risk resilience partnership fostering research on systemic risk with Swiss Re Institute



AXA and Swiss Re are two prominent re/insurance companies with a strong connection to science, led by their scientific philanthropic initiatives — respectively the AXA Research Fund and the Swiss Re Institute. In November 2023, they launched a collaboration to help build resilience to systemic risks with the help of innovative science, jointly operated by the Swiss Re Institute and the AXA Research Fund.

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By building the data infrastructure to track and predict outbreaks in real-time, we can change how countries respond, enabling a shift from reacting to epidemics to preventing them.

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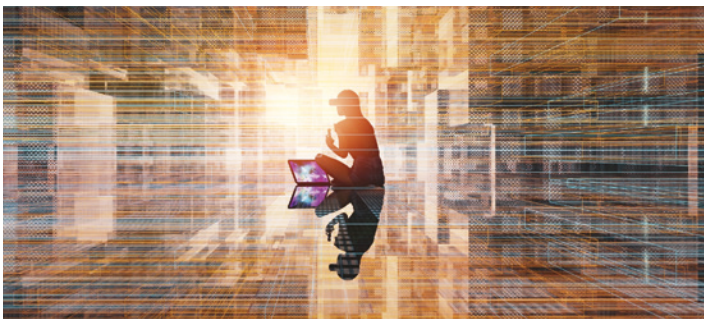
Dr. Oliver Brady,
Associate Professor,
London School of Hygiene & Tropical Medicine

The partners contributed equally to a total budget of €1M, which will help advance research on systemic risk over the next three years.

The first call for projects was launched consecutively: Building resilience against systemic cyber risk

Recently, there has been growing concern about “systemic cyber risk”—the possibility that a single incident could cause ripple effects with potentially catastrophic consequences. A systemic cyber fallout could threaten the digital infrastructure that societies, economies, and governments rely on. However, research progress on this subject has been described as modest and the availability of data limited, leaving many unanswered questions. This can largely be attributed to the novelty of the topic, and its constantly evolving threat profile.

To reinforce cyber resilience, more understanding is needed. In light of this, the Swiss Re Institute and the AXA Research Fund have decided to collaboratively support academic research projects investigating how to increase cyber resilience for companies, governments, and society, looking at different resilience building approaches.





Connecting science with society to support decision-making

Disseminating science: From training to valorization

The dissemination of scientific facts to enable science-based decision-making and practices is the second pillar of the Fund, following funding. Dissemination begins with making science accessible — both comprehensible and available to a wider audience — and leads to a variety of outcomes, such as nonscientific publications, presentations, and videos. In 2023, the Fund expanded its support offerings with the introduction of a new masterclass format, further enhancing its value proposition to its grantees and to Society.

Popularizing and pitching: Share Your AXA Research 2023

In May 2023, 15 young scientists from the latest fellowships on the Health Impacts of Climate Change and Coastal Livelihoods Resilience attended a media training course with Dr. Elodie Chabrol to popularize and pitch their research.



Subsequently, they were invited to present their projects in front of an audience of AXA experts and the Fund's Scientific Board — a much valued opportunity for our scientists to practice, engage, and create collaboration opportunities.

Writing for The Conversation

The Conversation is a long-standing partner of the AXA Research Fund, sharing the same mission of supporting scientists' efforts to bring their research out of the lab and to broader audiences seeking scientific facts to understand and navigate the world. In 2023, we continued this partnership with a variety of articles published, where AXA-supported fellows shared insights on climate, health, and socio-economic issues.

Doing Laundry by Hand Sheds Just as Many Microfibres as Machine Washing - New Research



In an article for The Conversation, **Dr. Thomas Stanton**, AXA Post-doctoral Fellow at Loughborough University, challenged the hand washing of laundry with regards to microfibre pollution impact.

Between 6,500 and 87,000 tonnes of microfibres are shed during domestic laundering every year in the UK. Many of these minuscule fibres end up in rivers and oceans, with devastating consequences for aquatic animals and environments.

As a result, environmental advocacy groups in the UK, EU and North America are campaigning for legislation to mandate microfibre-catching filters for all new washing machines.

But microfibre pollution isn't limited to machine washing. Our new research shows that washing clothing by hand can shed just as many microfibres as laundry washed in a machine.

This is an issue. More than half of the global population doesn't have regular access to a washing machine and so launder "off-grid", such as by hand. Hand washing laundry often involves a lot of scrubbing and abrasion that sheds fibres. Wastewater from hand laundering may flow directly into rivers or onto concrete and stone "laundry decks", bypassing wastewater treatment facilities even where such facilities are available.

Resolving the microfibre pollution problem necessitates more than just installing washing machine filters. It requires changes in how textiles are designed, manufactured and traded on a global scale.



Read the full article >>>

Why the Pyrenees' Mountain Lakes are Turning Green



In this article for The Conversation, **Dirk S. Schmeller**, AXA Chair at the Institut National Polytechnique de Toulouse, highlights the concerning phenomenon of mountain lakes turning green in the Pyrenees and other regions.



I first set foot in the Pyrenees in 2006. Two years later, I began a large-scale survey of mountain lakes and amphibian populations: from east to west, I covered more than 100 mountain lakes located in the eastern Pyrenees to the Béarn region (Pyrénées-Atlantiques).

For our various projects, we came back to sample the same lakes at least once a year. Over time, we noticed changes, in particular the increased growth of algae cyanobacteria and sometimes dinoflagellates, the blue-green algae that turn many lakes green. Back in 2012, we informed the Pyrenees National Park (PNP) about our observations.

Over the years, I've seen many of these lakes change colour. Some have lost the clarity and blue we've all come to expect from a mountain lake, while others have started to take on a greenish hue or even a bright green, particularly at the end of summer.

This trend does not affect any one region more than another: it can be found in the Ariège Pyrenees, the central mountains of the Pyrenees, as well as the western Béarn region. This is not a rare, localised phenomenon, but a large-scale event that is set to spread over the coming years. We're also seeing it on the other side of the border, in the Catalan Pyrenees, where my colleague

Marc Ventura has been leading the European Limnopirineus project.

In the Alps, colleagues at the research centre for high-altitude ecosystems (in French: Centre de recherche des écosystèmes d'altitude, Crea) have made a similar observation. Even in the Canadian Rockies, a clear growth in algae has been observed.

We have identified four main causes of this greening of the lakes.



[Read the full article >>>](#)

Quantum Computers Threaten our Whole Cybersecurity Infrastructure: Here's How Scientists Can Bulletproof It



Prof. Antonio Acin, AXA Chair in Quantum Cryptography at ICFO, discusses the threat quantum computers pose to cybersecurity and proposes strategies for fortifying the current infrastructure. He also shares insights on how scientists can safeguard our cybersecurity from potential quantum threats.

Thirteen, 53 and 433. That's the size of quantum computers in terms of quantum bits, or qubits, which has significantly grown in the last years due to important public and private investments and initiatives. Obviously, it is not only a mere question of quantity: the quality of the prepared qubits is as important as their number for a quantum computer to beat our existing classical computers, that is, to attain what's called the "quantum advantage". Yet it is conceivable that soon quantum-computing devices delivering such an advantage will be available. How would this affect our daily lives?

Making predictions is never easy, but it is agreed that cryptography will be altered by the advent of quantum computers. It is an almost trivial statement that privacy is a key issue in our information society: every day, immense amounts of confidential data are exchanged through the Internet. The security of these transactions is crucial and mostly depends on a single

concept: complexity or, more precisely, computational complexity. Confidential information remains secret because any eavesdropper wanting to read it needs to solve an extremely complex mathematical problem.

In fact, the problems used for cryptography are so complex for our present algorithms and computers that the information exchange remains secure for any practical purposes — solving the problem and then hacking the protocol would take a ridiculous number of years. The most paradigmatic example of this approach is the RSA protocol (for its inventors Ron Rivest, Adi Shamir and Leonard Adleman), which today secures our information transmissions.

The security of the RSA protocol is based on the fact that we don't yet have any efficient algorithm to factorise large numbers — given a large number, the goal is to find two numbers whose product is equal to the initial number. For example, if the initial number is 6, the solution is 2 and 3, as $6=2 \times 3$. Cryptographic protocols are constructed in such a way that the enemy, to decrypt the message, needs to factorise a very large number (not 6!), which is at present impossible to do.

If computing devices are built for that would allow current cryptography methods to be easily cracked, our current privacy paradigm needs to be rethought. This will be the case for quantum computers (once an operational quantum computer exists, that is): they should be able to break RSA because there is a quantum algorithm for efficient factorisation. While classical computers may need the age of the universe to such a problem, ideal quantum computers should be able to do it in a few hours or maybe even minutes.

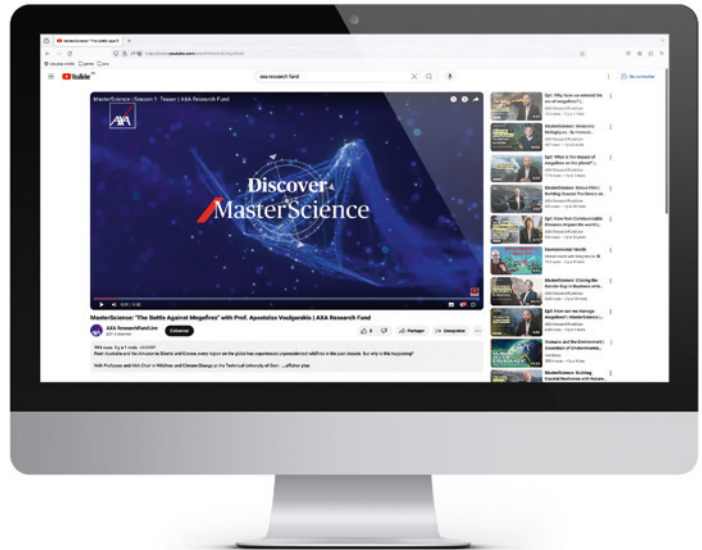
This is why cryptographers are developing solutions to replace RSA and attain quantum-safe security, that is, cryptographic protocols that are secure against an enemy who has access to a quantum computer. To do so, there exist two main approaches: post-quantum cryptography and quantum key distribution.



[Read the full article >>>](#)

MasterScience: An open access masterclass with best insights from our leading scientists

An embodiment of our new mandate objective was the launch of a MasterScience, in summer 2023: Our masterclass program targets interested audiences of decision-makers, practitioners, and curious minds. It provides them best scientific insights on the main challenges of our time in less than 30 minutes.



MasterScience is openly available on:



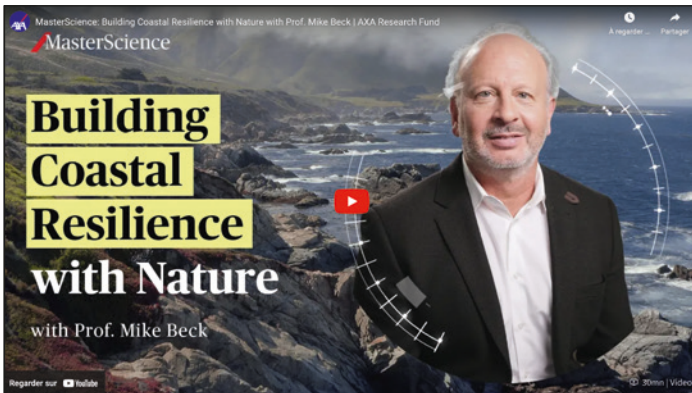
our website:
axa-research.org/masterscience



YouTube channel:
AXA Research Fund Live



The masterclass in 3 main chapters



Our masterclasses include an analysis of causes and consequences of the issues studied, as well as the presentation of possible routes to address them.

Chapter 1

The vulnerability of the coasts



1.1 The rapid loss of coastal habitats

Coastal development, over-fishing and pollution have led to terrible losses in terms of coastal habitats worldwide.

1.2 Coasts are facing growing natural disasters

There is a much greater problem for our coastal infrastructure than sea-level rise: rising waves.

Chapter 2

Adapting to climate change thanks to nature-based solutions



2.1 Wetlands protect people and property

Wetlands, including marshes and mangroves, act as natural coastal defenses that protect people and property from flooding.

2.2 Reefs break big waves

Reefs are providing critical coastal protection that has been widely overlooked. We need to restore them.

Chapter 3

Solutions to develop resilience



3.1 We can reduce risks by investing in nature-based solutions

Today we spend most funds to manage natural disasters after they happen, not before.

3.2 Including environmental assets in national economic accounting
Natural Capital Accounting can help to change policies about how we manage nature.

3.3 Insuring nature as an asset

We could insure nature as asset – just like our homes. And other solutions.

3.4 Rethinking public and private infrastructure investments

We have not reached the tipping point where nature-based solutions are regularly considered. How to get there?

Engaging science with users

Connecting science with its users through outreach activities is a longstanding core practice of the Fund, taking many forms: webinars, conferences, and publications targeted to decision-makers and practitioners. Below are a few such activities carried out in 2023.

Booklet on climate change impact on coasts

Prof. Roshanka Ranasinghe, AXA Chair in Climate Change Impacts and Coastal Risk at the Department of Coastal & Urban Risk & Resilience, IHE Delft, published a booklet aimed at creating awareness and calling for action on the issue with the support of the AXA Research Fund.

The booklet, which presents the expected impacts of climate change on coastlines to frontline professionals and the general public, is downloadable on the UN-IHE Institute for Water Studies website.



Cyber Ambassadors Project: Training students against cybercrime

Dr. Vivian Ugwuja was supported by the AXA Research Fund for her Post-doctoral research at University of Port Harcourt (Nigeria) on how to best financially include women in Nigeria. Her work investigated the access to online banking services to inform the design of effective and sustainable policies tailored to the sector and the specific needs of female-headed farm households in the country.

Nigeria is also faced with a high rate of cybercrime which has led to significant financial losses and negatively impacted the digital economy making online banking especially vulnerable. The AXA Research Fund renewed its support to Dr. Ugwuja for an outreach project focusing on cybersecurity training for students in public secondary schools and tertiary institutions in Rivers State (Nigeria). Partnering with public and governmental agencies, and cybersecurity experts, she provided comprehensive training on cyber threats, safer banking practices, responsible internet use, cybercrimes and their implications, responsible use of social media, computer and mobile device security. The training was disseminated through workshops, pamphlets and social media platforms.

A total of 2,309 students from various educational institutions were empowered to understand the legal and financial consequences of cybercrime and equipped to stay safe in the online environment.



Enhancing our role in the philanthropic network

We are convinced that collaborative players are more powerful than the sum of individuals, and we are seeking to take part in collective action in favor of science philanthropy for a better world. We also seek to develop our own initiatives to expand and consolidate existing networks.

In June 2023, alongside 23 other philanthropic organizations, we signed the Monaco Statement, dedicated to amplifying the role of the philanthropic community in global ocean action as part of the UN Ocean Decade. This joint statement was launched on the sidelines of the Sustainable Development Goals Summit 2023 in New York City, USA.

We also initiated discussions with several academic and philanthropic players to expand our reach.









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