

Julien Guerrier

Horizon Europe: a gateway to the future

Research and innovation are critical to boost the resilience of Europe's societies and economies. They are fundamental in order to build our competitive leadership in the global race for technology. We need a strong injection of research and innovation investments to support Europe's recovery and its digital and green transformation. The challenges are great and many - accelerating Europe's transformation through the European Green Deal, including the commitment to climate neutrality by 2050, making Europe fit for the digital age and creating an economy that works for people – but research and innovation are key to tackling them all. The COVID-19 pandemic has demonstrated how important it is to cooperate in science and innovation in order to quickly respond to society's most pressing needs. The European Commission acted at the very beginning of the outbreak, investing in urgently needed research and innovation and coordinating European and global research efforts. We mobilised funding from the EU research and innovation programme, Horizon 2020, to advance our knowledge on the virus, to develop tests, treatments and vaccines, and to improve clinical management of patients as well as public health response. By the end of the year, we will have invested over €1 billion as part of the Coronavirus Global Response initiative. Through the ERAvsCorona action plan, we have been coordinating research and innovation efforts with national administrations. We intend to continue with additional research and support actions, including support for the infrastructures and data resources that enable decisive research.

The Structure

The EU intervention through the European Framework Programmes comes in when more needs to be done at EU scale than the national or regional scales alone. This to deliver better, faster or more efficiently on common objectives. Building on past achievements, the next programme Horizon Europe will come with a set of evolutions compared to Horizon 2020. Horizon 2020 is a European success story and an asset for the Union; Horizon Europe will build on this success under the guiding principle of 'evolution not revolution'. Horizon Europe will also build on foresight with a forward-looking appreciation of challenges and opportunities for Europe in a rapidly changing world. Learning the lessons from Horizon 2020, the Horizon Europe design and implementation modalities will rationalise the EU funding landscape for R&I, and maximise its impact, its relevance to

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Box 1

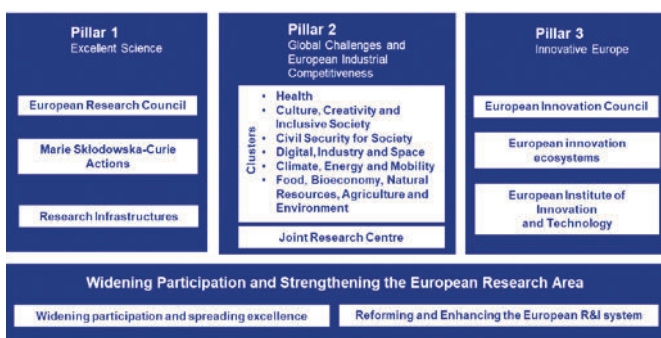
Acting fast together and at large scale in the coronavirus crisis

- The research and innovation programme is at the forefront of supporting research and innovation efforts, including preparedness for pandemics: €4.1 billion were invested from 2007 to 2019 on infectious diseases, including initiatives to address antimicrobial resistance, as well as preparedness and emergency response to outbreaks ([Ebola](#), [Zika](#))
- In 2020, with Horizon 2020 flexible funding instruments adapted to dealing with emergencies, about €500 million were mobilised within six months for research and innovation support. The selected [projects](#) involve hundreds of research teams across the world and address epidemiology, preparedness and response to outbreaks, the development of diagnostics, treatments and vaccines, as well as the infrastructures and resources that enable this research.
- To strengthen global coordination, the EU, together with several partners, kicked off the [Global Response pledging event](#) in May 2020, which has now raised €9.8 billion in pledges from donors worldwide to kick-start the global cooperation. This includes a pledge of €1.4 billion from the Commission of which €1 billion comes from [Horizon 2020](#). The EU has contributed to finance the BioNTech vaccine.
- In April, the Commission and national ministries also agreed on the first [ERAvsCorona action plan](#). It lays out 10 priority short-term coordinated actions based on close coordination, cooperation, data sharing and joint funding efforts. It is already [delivering results](#), including a [European COVID-19 Data Platform](#), or the EU-wide clinical trial network, which will coordinate planning and implementation of large-scale clinical trials across the EU based on harmonised protocols.
- These actions will not only deliver short-term solutions to fight the crisis, but may lay the grounds for stronger EU cooperation on preparedness in view of future pandemics.

The €1 billion from Horizon 2020 for the Coronavirus Global Response event can be broken down in (as of July 2020):



society and its potential for breakthrough innovation. Horizon Europe is designed to promote systemic transformations at the intersection of disciplines, sectors and policies. It will privilege purpose and value over instruments and clients, mobilising all actors needed to achieve its goals (industry, academia, research centres, public authorities, foundations, civil society, end-users etc.). There will be a strong degree of continuity: three pillars, excellence at the core, changing as little as possible in rules and procedures for participation. Open science, open innovation and open to the world will be in the DNA of Horizon Europe. The first pillar (‘Excellent Science’) will provide bottom-up support to frontier science. The second pillar (‘Global Challenges and European Industrial Competitiveness’) will provide support to collaborative research and innovation for addressing the grand challenges of our time, as embodied in the UN’s sustainable development goals. This pillar will be implemented through usual calls for proposals, through a streamlined set of partnerships and through missions. The third pillar (‘Innovative Europe’) will foster market-creating innovation. The pillars will be underpinned by actions to strengthen the European Research Area, in particular to share excellence across Europe and for policy measures to reform the R&I system.



What’s new

In particular, Horizon Europe will cut across silos, sectors and disciplines to deliver scientific, technological, economic and societal impact. To reinforce the delivery on EU priorities and address global challenges while strengthening EU competitiveness, priorities for joined investments will be strategically planned and co-created with stakeholders and citizens. This includes EU Missions of common interest, and strategic European Partnerships with Member States and industry. In parallel the European Innovation Council

will identify through pan-European competition Europe’s most innovative start-ups and SMEs to help them bring new solutions to the market. A reinforced approach to monitoring impact will also allow singling out the programme’s EU added value over time, e.g. the impact of the Programme investments on climate action.

Box 2

Key evolutions of Horizon Europe (2021-2027) compared to Horizon 2020 (2014–2020)

In addition to what was working successfully under Horizon 2020, the approach for maximising the added value of Horizon Europe revolves around a set of key evolutions:

- **Strategic planning** is a new way of setting research and innovation priorities, in line with EU priorities and commitments, and in co-creation with Commission services, Member States, stakeholders and civil society. It will be a multiannual strategy, while preserving flexibility to respond rapidly to unexpected crisis or policy needs.
- **Clusters:** The global challenges are too complex for an individual EU country, scholar, discipline, or technology to deliver solutions. Interdisciplinarity, breaking silos and working in clusters, which bring together different disciplines and policy areas – from frontiers research to close to market applications – are key to deliver increased value for society.
- **Co-designed EU missions** will set directions to achieve ambitious objectives with societal relevance through cooperation across sectors and disciplines in the following areas: cancer, adaptation to climate change; healthy oceans, seas coastal and inland waters; climate-neutral and smart cities; soil health and food. They are being co-designed with citizens and stakeholders.
- **The European Innovation Council**, which combines an advanced science-and-tech research programme with an accelerator programme for start-ups and SMEs will provide EU-wide competition to support visionary innovators, researchers and entrepreneurs in realising their ventures and bringing new solutions to the market.
- **European Partnerships** will be refocused towards providing clear EU added value through strategic cooperation between public and private actors along strategic agendas in critical areas such as clean energy, transport, health, food and circularity.
- **Reinforced synergies** between EU programmes will support the development of a more coherent European research and innovation system working together with national and regional levels, incl. for the deployment and scale-up of proven technologies.

- **Open Science** will become the modus operandi of Horizon Europe and reinforce the open diffusion of knowledge generated. It will go beyond the open access policy of Horizon 2020 and require open access to publications, data, and to research data management plans.
- **Reinforced monitoring system around Key Impact Pathways**, which will help capture the added value of the programme better and the difference it is making over time for society, for the economy and for scientific progress.

In particular, Missions will play a big role. EU Missions are a response to some of the most pressing societal challenges our world faces. They are an integral part of the Horizon Europe framework programme, which begins in 2021.

Missions will consist of a portfolio of actions across sectors and disciplines, combining different funding instruments and policy actions. Each Mission is a tool to provide concrete, transformational and systemic responses to a pressing challenge by defining a clear goal, objectives and timeline. They provide added value to existing initiatives, bring together R&I actions with financial support for their deployment and support policy and the legislative environment.

Five mission boards have been created to help specify, design and implement missions for Horizon Europe. They formulated their advice engaging with Member States, stakeholders and citizens. Citizens' engagement will be continuous in the various processes for the design, monitoring and assessment of the missions.

In the European Commission, the missions are led by teams which bring together all interested Directorates-General. Member States have been kept closely informed of progress including groups of national experts for each mission area, linked to the Strategic Configuration of the Shadow Programme Committee for Horizon Europe.

In September 2020, each Mission Board presented their proposals to the European Commission for possible EU missions. Missions will be programmed within the Pillar II 'Global Challenges and European Industrial Competitiveness' of Horizon Europe. They may also benefit from actions carried out within other parts of the Programme as well as complementary actions carried out under other Union funding programmes such as the European Green Deal, the EU industrial strategy, digitisation or the recovery plan among others. A significant budget will be provided for each mission.


In Horizon Europe, we will have also a new wave of partnerships. The new partnerships will ensure long-term strategic cooperation between public and private actors covering critical areas such as energy, transport, biodiversity, health, food and circularity.

A collaborative programme


The question of scale is at the core of Horizon Europe since its conception. It focuses on supporting collaboration and excellence-based competition across different countries - overcoming geographic, sectoral or disciplinary boundaries. By pooling resources, it generates a critical mass of resources and talent, avoiding duplication of efforts across countries and delivering efficiency gains. When research activities are of such a scale and complexity that no single Member State can provide the necessary financial or personnel resources alone, it helps sharing and leveraging sufficiently large investments, including for pan-European research infrastructures. For example, only EU-level action can overcome the thin distribution of millions of patients affected by multiple **rare diseases** and the lack of standardisation and data. Or allow the EU to reinforce the future industrial positioning of its value chains in the key technologies world game, e.g. by joining long-term research efforts for future batteries (**Battery 2030+**). Overall, according to its **impact assessment**, Horizon Europe has the potential to deliver up to €11 in Gross Domestic Product (GDP) gains for every euro invested, and create up to 320.000 new highly skilled jobs by 2040.

Box 3


R&I boosts the EU's productivity, jobs and global competitiveness



2/3
of EU productivity growth over the last decades has been driven by R&I investments



€11
Estimated leverage effect of each euro invested in R&I at EU level



€400-600 billion
by 2030 is the estimated GDP gain from Horizon 2020

The creation of wide cooperation networks, of trans-European research infrastructures, the training and mobility of skilled people and the excellence-based competition for grants raise the quality and visibility of projects that get funded. This creates an attractive breeding ground of top researchers and innovators with excellent ideas. It also reinforces access to markets and knowledge transfer, including through the development of common standards and interoperable solutions, but also by promoting open access policies for scientific results and data.

This consolidation of research and innovation capacities lays the foundations of current and future strategic autonomy and resilience of the EU – allowing to be prepared to react better and faster to emerging technological opportunities, but also to global socio-economic shocks, such as the Covid 19 crisis. More than ever the ability to deploy existing capacities to respond quickly and effectively today depends on the visionary investments made yesterday.

Box 4

A massive cooperation network producing quality results

- A massive Horizon 2020 network of more than 1.5 million collaborations between organisations worldwide ([Monitoring Flash #3](#), 2020).
- Producing quality results with EU-funded peer-reviewed scientific publications cited more than twice the world average (Field-Weighted Citation Index of 2.3), and 3 times more represented in the world's top 1% of cited research compared to publication output of EU Member States (Scopus).

Next Steps

We are co-designing the programme together with researchers, businesses, decision makers and the people. Our strategic planning process has included a series of unprecedented co-creation and co-design activities involving the European Parliament, our stakeholders as well as citizens. The second edition of the European Research & Innovation Days in September 2020 has given the floor to 500 speakers and 30000 participants across Europe to discuss the main dimensions of EU research and innovation policy, and its contribution to the recovery and future of Europe and its citizens.

In parallel to the new programme, we will relaunch the European Research Area. Through it, we will join forces with all EU countries to prioritise investment and reforms in research and innovation, improve access to excellence for researchers across Europe and ensure results find their way to the market. In addition, the new Recovery and Resilience Facility will aim to ensure that we fully exploit the potential of research and innovation in our economic recovery as well as in making our economies and societies more resilient. We cannot achieve the large-scale transformations of our socio-economic systems without giving a central role to research and innovation.

Throughout the past year, we have all seen the crucial role that research and innovation play in our lives, and what we can achieve if we focus our efforts. Despite the disappointing cuts proposed for the Horizon Europe budget, I am looking forward to seeing the essential contribution of research and innovation in tackling Europe's fundamental challenges and making us better prepared for the future. I strongly believe that we are doing the right thing.

Julien Guerrier,

Director of the Policy and Programming Centre of the European Commission's Directorate-General for Research and Innovation



Julien Guerrier has been working for more than 25 years at the European Commission, mainly on industrial and research policy, international trade negotiations and corporate management issues.

He is currently in charge of the Directorate developing the overall policy for the EU funding programme for research and innovation, Horizon Europe.

As a representative of the Commission, he also headed the EU-Japan Centre for Industrial Cooperation in Tokyo (2008-2011) and the European Agency for Small and Medium-sized Enterprises (2017-2020), which manages the COSME Programme for the competitiveness of SMEs, parts of HORIZON such as the pilot European Innovation Council, LIFE and the European Maritime and Fisheries Fund.

Before joining the Commission, he was at the French Ministry of Public Works and participated in an exchange of officials with the Japanese administration, where he worked for one year.

Julien Guerrier graduated from Ecole Polytechnique and Ecole des Ponts et Chaussées in France and holds an MBA.

Stimmen aus der Wissenschaft

"Back to the Year 2050"

Looking forward to our Fantastic Voyage in the next decades, we will likely fly to the international chemistry conference in 2050 in an airplane powered by synthetic fuel made from carbon dioxide and hydrogen produced with electricity from the latest generation solar collectors. This has been made possible by amazing catalysts for CO₂ conversion and optoelectronic materials shadowing Nature's photosynthesis efficiency; breakthroughs reminiscent of the Haber Bosch process for ammonia and fertilizers at the dawn of the 20th century. Soft electronic material integrated with my skin will check my health during the flight and control and automatically adapt my circadian rhythm. In my lecture the latest results on a self-propelled molecular nanorobot, that is capable to deliver a drug with high precision in the living cell, based on the recent fantastic advances in molecular recognition in complex systems, will be presented. I very much look forward to the session on artificial life, were several young colleagues will discuss the first synthetic molecular systems that are qualified as alive by all standards. One of the greatest scientific mysteries finally solved?



Ben L. Feringa
Nobel-Preis für Chemie 2016

Stimmen aus der Wissenschaft

Es gibt natürlich eine Vielzahl von Aufgaben bei der Erforschung bereits existierender und neuer Materialien und deren Reaktivität. Die Physikalische Chemie zeichnet sich m.E. aber auch mehr als andere Fächer durch das Bestreben aus, bestehende Grenzen zu überschreiten und damit neue Tore aufzustoßen. Mit dem verfügbaren experimentellen und theoretischen Rüstzeug (wofür ich in nächster Zeit keine grundlegenden neuen Entwicklungen erwarte) werden fundamentale Probleme in den Nachbardisziplinen Biologie und Physik in Angriff genommen werden. Dazu zählen natürlich die Frage „Was ist Leben“ wie auch die Untersuchung neuartiger Quanteneffekte und insbesondere auch von Phänomenen der Selbstorganisation in offenen molekularen Systemen. Ich bin sicher, dass dies eine aufregende Zeit werden wird.



Gerhard Ertl
Nobelpreisträger 2007
Ehrenmitglied der DBG 2006
Inhaber der Bunsen-Denkmünze 1992

Stimmen aus der Wissenschaft

Ten lines for the past of the future

Being asked to provide ‚ten lines‘ leading us back to 2050, we summarize ten important questions and problems related in a broad sense to Physical Chemistry and Chemical Physics, which are expected or hoped for to possibly find answers and solutions by 2050. This is a small selection and there are many more, referring as examples to the 7 and 42 open questions just for the frontiers of spectroscopy (M. Quack, Faraday. Discussion 150(2011)533-565) and perhaps the most important development may come from a surprising, totally unexpected discovery related to a question nobody thinks of today.

1. What will be the best technologies for environmentally benign (greenhouse gas free or CO₂ - neutral) chemical and electrochemical energy storage and conversion, primary energy sources being for sure CO₂ - neutral (solar-, wind-, hydro-, carbon capture- etc.) by 2050, as we hope.
2. Development of a quantum technology for quantum computing and information with molecular or solid state materials.
3. Quantitative experimental determination of the parity violating energy difference between the ground states of enantiomers of chiral molecules – confirmation or rejection of currently existing predictions for this quantity (sub feV typically depending on the molecule).
4. Total synthesis of a new form of life, either fundamentally new or, for example, of an enantiomeric ‚mirror image‘ form of a simple existing living species (bacterium etc.), relating it to the question of the origin of biomolecular homochirality.
5. Proof of life on another planet or moon in the solar system (by ‚real space travel‘ and observation) or on an exoplanet, for instance by convincing spectroscopic evidence using chiroptical spectroscopy proving homochirality in molecular systems there.
6. The electron mass (and charge) is an empirical parameter determining the structure of all ‚chemical matter‘: Can we find a theory to calculate it ‚ab initio‘ from some underlying first principles and is it then a constant in time or time- dependent?
7. ‚Dark matter‘ is considered proven by gravitational effects to make up much of the matter of the universe: Can we determine its material nature (by spectroscopic or other techniques)?
8. Development of a quantitative theory for the violation of time reversal symmetry in molecular processes and its experimental confirmation or rejection.
9. Proof of the violation of CPT symmetry by experiments using atomic and molecular spectroscopy or other techniques and theory for the effect, if any.
10. Can we clarify and understand the biochemical, molecular basis of the quantum dynamical primary processes governing our thoughts, decisions and memories?



Martin Quack
1. Vorsitzender der DBG von 2011–2012
Inhaber der Wilhelm-Jost-Gedächtnis-Vorlesung 2004
Preisträger des Nernst-Haber-Bodenstein-Preises 1982