



International
**Human Frontier
Science Program**
Organization

Europe*

in the

Human Frontier Science Program



* This document presents HFSP information for the countries that are represented by the European Commission's membership in HFSP, and therefore it does not include information for France, Germany and Italy, that are members in their own right.

October 2021

Contents

1	Europe in HFSP: a value-added partnership.....	2
2	HFSP programs and their goals.....	4
2.1	HFSP Research Grants (Research Grants-Program and Research Grants-Early Career)	4
2.2	HFSP Postdoctoral Fellowships.....	4
2.3	HFSP Nakasone Award	5
3	A global player supporting international scientific cooperation	6
3.1	The impact of HFSP funded research	7
4	Towards the same goals: research for our future	9
5	Europe’s success in HFSP research programs.....	12
5.1	What scientists say about HFSP awards.....	14
5.2	Prizes and awards.....	16
6	HFSP invests in Europe’s scientific future.....	17

The Human Frontier Science Program (HFSP) is unique, supporting international collaboration to undertake innovative, risky, basic research at the frontier of the life sciences. Special emphasis is given to the support and training of independent young investigators, beginning at the postdoctoral level. The Program is implemented by the International Human Frontier Science Program Organization (HFSP/O), supported financially by Australia, Canada, France, Germany, India, Israel, Italy, Japan, the Republic of Korea, New Zealand, Singapore, Switzerland, the United Kingdom of Great Britain and Northern Ireland, the United States of America, and the European Commission. Since 1990, over 7000 researchers from more than 70 countries have been supported. Of these, 28 HFSP awardees have gone on to receive the Nobel Prize.

1 Europe in HFSP: a value-added partnership

Basic science is highly valuable as a driver of future economic and social benefits, and many countries promote international scientific cooperation, which is not only an absolute necessity to push forward the scientific frontier but also a way of fostering mutual understanding between countries. These principles, which are shared between the International Human Frontier Science Program Organization (HFSP) and the European Commission, are strongly reflected in Europe's research strategy Horizon 2020 and will play an even bigger role for the next framework programme "Horizon Europe" offering a foundation for a continued partnership between the European Commission and HFSP.

The European Commission, as a member of HFSP, in accord with the statutes of the Organization, represents all the European countries that are not individual members of the G7. **Therefore, this report about European accomplishments does not include data for France, Germany, and Italy.**

Membership of HFSP is a strong signal of a high standard of scientific performance and offers an opportunity for members to invest in innovative, yet daring research through voluntary annual investments that enable the HFSP funding programs to select the most outstanding research projects.

HFSP programs represent a global benchmarking exercise because the competitions are truly global attracting applications from more than 30 different countries each year. Members are reassured that successful applicants represent the very best in their country and belong to the top tier of the global life science community.



HFSP and ERC booths at the AAAS meeting in Boston, 2013

Research support for European scientists through HFSP programs goes back to the very beginning of the Program in 1990, and since that time HFSP has maintained a high level of engagement with European scientists and institutions alike.

Highlights of HFSP engagement in Europe



- Since 1990, a total of 583 young scientists from European countries were supported by HFSP postdoctoral fellowships and some 435 investigators received support for intercontinental collaborations via HFSP research grants.
- Young scientists from Europe are key competitors for HFSP fellowships.
- European research institutions are important destinations for foreign scientists supported by HFSP.
- The 17th HFSP Awardees Meeting was held at the Champalimaud Centre for the Unknown, Lisbon, 9-12 July 2017.
- Strasbourg, a European capital, is the host city of the HFSP headquarters and was the venue for the 25th and 30th anniversary celebrations of HFSP.
- Since 1990, European venues in Portugal, Germany, France, Italy and the UK have hosted a total of six HFSP Awardees Meetings 2001-2017.

Contributions
1990-2021
108 million USD

Disbursements
1990-2021
247 million USD

2 HFSP programs and their goals

HFSP schemes are highly competitive, but also highly prestigious. This prestige, together with the fact that the schemes provide researchers with unique opportunities to work collaboratively across all countries and disciplines, attracts many outstanding applications each year. Support programs are available to fund team efforts through the research grants and young up-and-coming scientists through postdoctoral fellowships.

2.1 HFSP Research Grants (Research Grants-Program and Research Grants-Early Career)

Grants provide three years of support for international teams involving at least two countries. Preference is given to intercontinental collaborations (rather than all North American or all European teams). All team members are expected to broaden the scope of their research with respect to their ongoing research programs and interact with colleagues with expertise that is very different from their own so as to create novel approaches to problems in fundamental biology. All members of a **Research Grant-Early Career** team must be within five years of establishing their independent research group and no more than 10 years from their doctoral degree. **Research Grant-Program** teams may consist of team members at any stage of their career as independent investigators. There is a single annual competition for HFSP research grants, and a full description of the review process is available at:

www.hfsp.org/funding/hfsp-funding/research-grants#review_procedures

2.2 HFSP Postdoctoral Fellowships

Fellowships support innovative, groundbreaking projects that may involve risk but have the potential to advance knowledge in the applicant's field of study or open a new approach to a research problem.

Long-Term Fellowships support applicants with a degree in the life sciences to obtain training in a new area of research.

Cross-Disciplinary Fellowships are intended for postdoctoral fellows with a degree outside the life sciences who wish to receive training in biology.

HFSP fellows receive three years of support to obtain training in an outstanding laboratory of their choice in another country.

The annual competition for HFSP fellowships is explained in detail at:

<https://www.hfsp.org/funding/postdoctoral-fellowships>.



Pure diversity on display

Leading-edge life scientists gathered in Japan to present their latest results and learn from each other



The 19th HFSP Awardees Meeting in Tsukuba, Japan, provided many opportunities for life science researchers to mix with others working in diverse fields.

2.3 HFSP Nakasone Award

This award is an annual award for groundbreaking contributions or breakthrough discoveries in the life sciences. The award recognizes the vision of former Prime Minister Nakasone of Japan in the creation of the Human Frontier Science Program.

The HFSP Nakasone Award recognizes achievements in scientific excellence that have moved the frontiers of knowledge in biology. The award is for a particular discovery or set of discoveries. It is not a lifetime achievement award.



A list of former winners is on the HFSP website at <https://www.hfsp.org/awardees/hfsp-nakasone-award>. The selection of the award winner is the responsibility of the HFSP Council of Scientists.

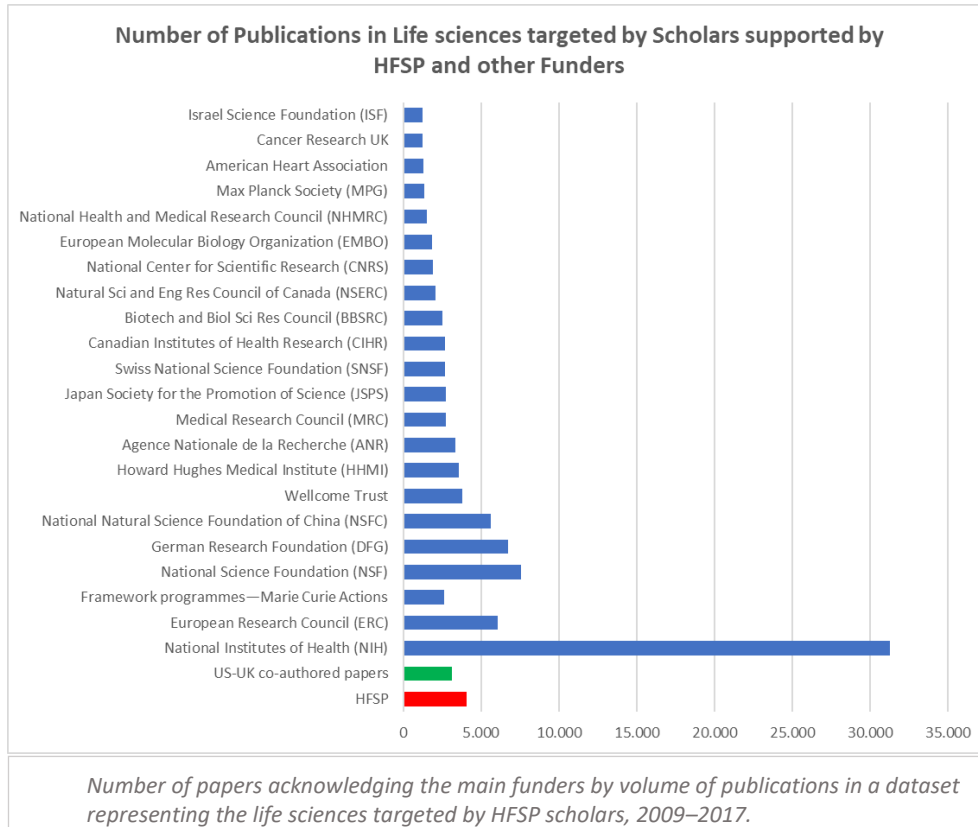
3 A global player supporting international scientific cooperation

At the 1987 Venice Economic Summit, the heads of state of the G7 welcomed the proposal by Prime Minister Nakasone of Japan to establish the International Human Frontier Science Program Organization. The original supporting HFSP Members were the countries of the G7, together with the EU represented by Jacques Delors. Switzerland joined in 1991. Since 2004, Australia, the Republic of Korea, India, New Zealand, Singapore, and Israel have joined the Organization. The founding nations have established HFSP as an international program of research support, funding frontier research on the complex mechanisms of living organisms. In so doing, HFSP has created for itself a unique niche to address the paradox that science is international while its institutions and funding organizations are mostly nationally or even regionally organized.



From left to right: Wilfried Martens, Jacques Delors, Yasuhiro Nakasone, Margaret Thatcher, Ronald Reagan, Amintore Fanfani, François Mitterrand, Helmut Kohl and Brian Mulroney.

With a limited budget of about 54 million USD, HFSP occupies a niche for basic research at the frontier of knowledge in the life sciences. Although HFSP's budget is many times smaller than that of the biggest funders in the life sciences and basic biomedical research, scientists supported by HFSP awards belong to the most prolific and productive tier of the global life science community with a publication output that compares very well with other leading funding bodies.



3.1 The impact of HFSP funded research

On average, HFSP funded research results in about 1000 scientific articles per year. Publication output is driven mostly by HFSP postdoctoral fellows who are still building their reputation with the goal to support their next career move. Publication numbers in research grants are very stable with about 500-600 publications per year, of which about 150-200 result from the HFSP Research Grants - Early Career (formerly known as Young Investigator Grants).

Year	Total publications	Career Development Award	Fellowships	Research Grants (includes Early Career)	Short Term Fellowships
2009	727	91	247	412	10
2010	947	127	286	545	15
2011	988	155	307	528	19
2012	1016	140	288	591	19
2013	1040	129	327	604	10
2014	1058	110	352	619	7
2015	1047	94	318	657	3
2016	947	87	304	579	1
2017	948	72	303	591	1
2018	893	64	293	563	0
2019	879	67	267	554	1
2020	911	67	279	576	2

The table above shows annual publication output by HFSP awardees according to major program categories. Short-Term Fellowships and Career Development Awards were discontinued but alumni continue to acknowledge HFSP support in their publications if the research was supported by HFSP funding. The number of total publications may be lower than all categories combined in cases where individual publications acknowledge more than one HFSP award in a single paper.

There have been regular bibliometric reviews on HFSP research output. The most recent one (2018) was carried out by the Canadian agency Science Metrix (available on the HFSP website at <https://www.hfsp.org/node/12547#book/>). A previous evaluation was done in 2010 by a consulting company from the UK at <https://www.hfsp.org/node/7013#book/>.

Research funded by HFSP has led to very high-impact papers (2nd among 28 other funders in the life sciences in general on most citation impact indicators), in spite of HFSP's niche approach of funding highly novel and high-risk projects that other funders were less likely to support. Indeed, while most HFSP papers acknowledged other sources of funds, research grant awardees reported that they would not have been able to pursue their research projects without HFSP funding.

When comparing their research with that of other funders, HFSP awardees' papers were very impactful over the 2009–2017 period. Their papers were cited twice as often as the world average, and a quarter of their papers appeared in the 10% most cited worldwide. HFSP ranked in the top three, out of 28 funders based on the citation distribution index (CDI), which offers an overall score of citation impact.

HFSP research also has a profound translational impact. When looking at the share of HFSP papers that were cited by patents, as a proxy measure for uptake in innovation, the resulting data shows that 9.6% of publications by HFSP fellows were cited in patents between 2009 and 2011. This is higher than the world's share of papers in the life sciences (3.6%) and in research areas in the life sciences targeted by HFSP scholars (5.4%).

Repeated assessments of HFSP funding programs demonstrate the success of the Program.

- All the indicators point to the high-impact level of the scientific outcomes.
- Bibliometric comparisons with other national or international funders, all much larger than HFSP, are stunningly convincing that the scientific returns on investment are significantly above world average.
- The analysis demonstrates the very high quality of the review and selection processes.
- HFSP postdoctoral fellowships are an undoubted "success story".
- HFSP research grants are unique in combining impact, multidisciplinary collaboration, and interdisciplinary research at the same time.

Selection principles for HFSP awards:

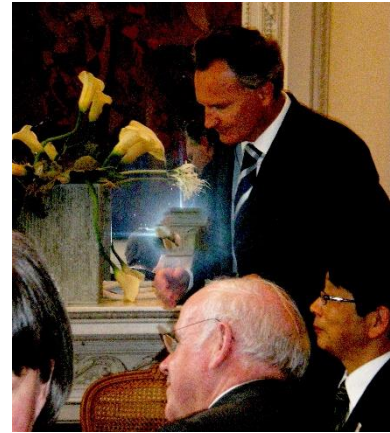
- Scientific excellence guides the selection of research projects
- Projects should pioneer new directions and therefore may contain risk
- Multilateral collaboration on an intercontinental scale
- Bridging disciplinary boundaries

4 Towards the same goals: research for our future

HFSP has been a high point of international cooperation for more than a quarter century with an extraordinary reputation for funding the best scientists and most challenging projects. Scientists and research institutions throughout Europe have played, and continue to play, a leading role in the success of HFSP research. As an international program HFSP has been a key pillar in the strategy for international research collaboration of the Framework programmes of the European Commission.

For Europe, this partnership began in 1990 when the European Commission joined HFSP representing the European countries that were not members of the G7. The success of HFSP as a globally operating hub for international research collaboration was a milestone that led to the implementation of the European Research Council in 2007. The first ERC Secretary-General, Ernst-Ludwig Winnacker, became the 4th HFSP Secretary-General in 2009.

Another important milestone was the 2013 Triennial Conference of HFSP Members (TCHM), which was organized under the auspices of the Director-General Research and Innovation, Robert-Jan Smits, who chaired the meeting. The decisions taken at this meeting were far reaching, setting the strategic course for the years to follow.



Robert-Jan Smits at the TCHM in Brussels, 2013

The ever-growing complexity and diversity of scientific research puts an increasing premium on international collaboration. Since joint action at an international level is always hard to achieve, it is important to build collaboration on tried and tested models. The Japanese government showed considerable foresight in initiating the Human Frontier Science Program and has made an outstanding and generous commitment to the Program during its existence. Japan's leading role in the foundation of HFSP and Europe's close relationship with Japan will place HFSP on the map for future bilateral engagements in science, technology and innovation.

HFSP research implements a bottom-up approach without topical priorities and it emphasizes themes relevant at the global level that give rise to emerging fields that investigate fundamental mechanisms making use of frontier approaches in material science, robotics, advanced computation, or nanotechnology. It is this open-science approach that makes HFSP so valuable for the newly established "Horizon Europe" work programme of the European Union because HFSP places great emphasis on basic science as a highly valuable driver of future economic and social benefits by means of international scientific cooperation, which is not only an absolute necessity in pushing forward the scientific frontier but also a way of fostering mutual understanding between countries.

In choosing HFSP as a partner for sustained international research collaboration, Horizon Europe benefits via the HFSP core values for the key activities of all three pillars: by supporting outstanding research at world class facilities (Pillar I); by pushing the frontiers of knowledge and technologies (Pillar II); and by enabling innovation through discovery research (Pillar III).

Added value through partnership	
Horizon Europe	HFSP
Pillar I: Excellent Science ...supporting outstanding research at world class facilities	... promoting international collaboration in the spirit of science without borders
Pillar II: Global Challenges and European Industrial Competitiveness ...pushing the frontiers of knowledge and technologies	... HFSP research is based on bottom-up, open scientific inquiry
Pillar III: Innovative Europe ...enabling innovation through discovery research	... supporting innovative, cutting-edge research at the frontiers of the life sciences

Pillar I - World class research at world class institutions by world class scientists

- European research institutions rank among the top six host institutions for HFSP research grants (1990-2021).
- Research institutions in the Netherlands, Sweden, Spain, Denmark, Belgium, Austria and Hungary are among the top 20 with the highest numbers of HFSP grant awardees.
- Applicants from Spain, the Netherlands, Austria, Greece and Belgium are among the top 20 contenders for HFSP postdoctoral fellowships out of 76 nations.

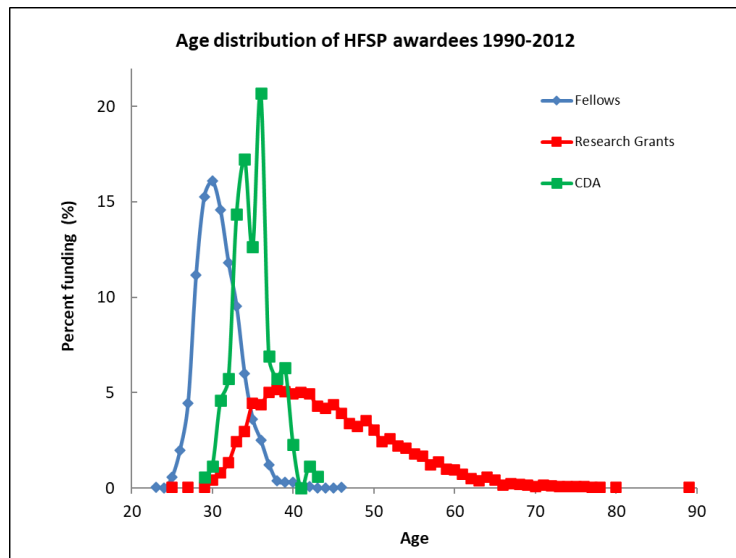
Pillar II - Breakthroughs at the frontier

- Probing patients by acoustic means: Electra Gizeli (2004 and 2020 HFSP research grant awardee), IMBB Heraklion, <http://biosensorslab.biology.uoc.gr/>
- What nature forgot when designing proteins: Clara Hlouchova (2019 HFSP research grant awardee), Charles University Prague, <http://khlab.org/>

Pillar III - Progress through innovation

- Protein network failure diseases: Ineke Braakman (1990 HFSP fellow), Utrecht University <http://cellular-protein-chemistry.nl/>
- Stem cell development in cancer: Cédric Blanpain (2003 HFSP fellow, 2006 CDA), Université Libre de Bruxelles, <https://blanpainlab.ulb.ac.be/>

HFSP support provides additional value because it comes at a crucial time when young researchers depend on financial help to embark on their research career. **In this way HFSP also offers a strong component of capacity building by supporting Europe's talents, who represent the next generation of leaders in science.**

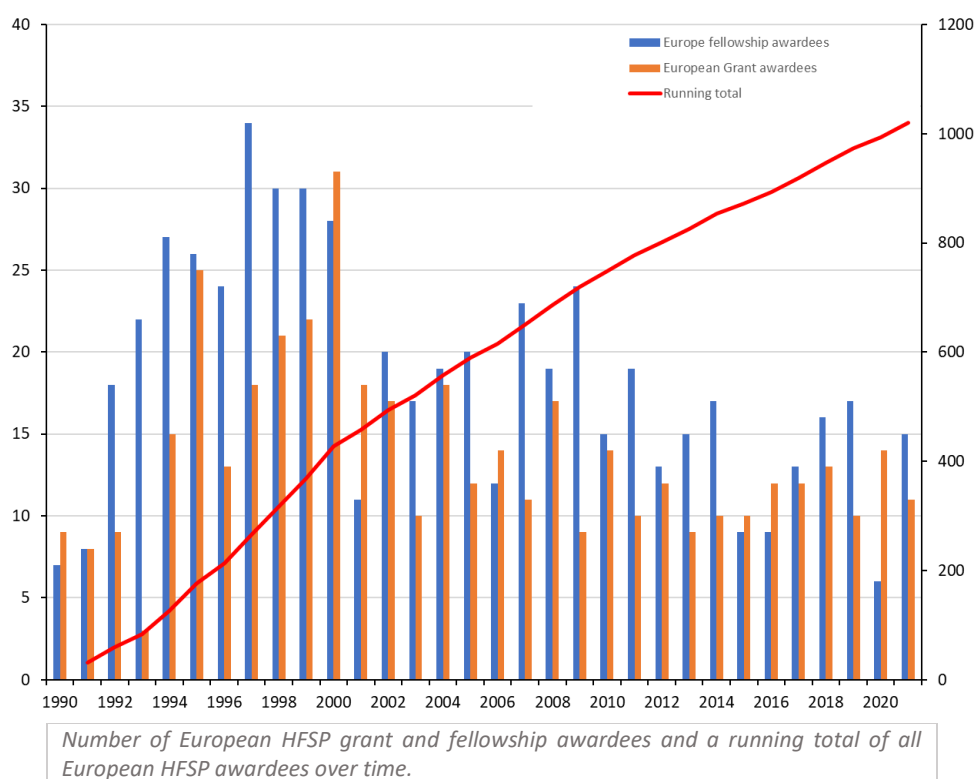


Through its support, HFSP covers a very important period in the academic career path. Postdoctoral fellowships support scientists in their mid-20s to late 30s and the average age of fellows is around 31 years at the time of receiving the award. The critical career transition to scientific independence was for many years supported via the Career Development Award (CDA). This program was terminated in 2019. However, HFSP fellows are provided with ample possibility to use their fellowship funding to transition to independence. The fellowship program compliments the HFSP research grants, where there is also a strong emphasis to support younger investigators.

5 Europe's success in HFSP research programs

Scientists from Europe are **among the most successful in HFSP programs supporting both young postdoctoral fellows and international research grant teams** (see figure below). Since 1990, researchers from Europe were supported by HFSP awards every single year, totalling 1020 HFSP grant and fellowship awardees. This level of HFSP support represents a significant investment in the support of individual scientists but also research institutions throughout the continent.

In spite of a decline in the number of awardees starting in 2001 (due to increased award amounts), the awards to European scientists continue to develop positively over the entire three decades of HFSP operations.

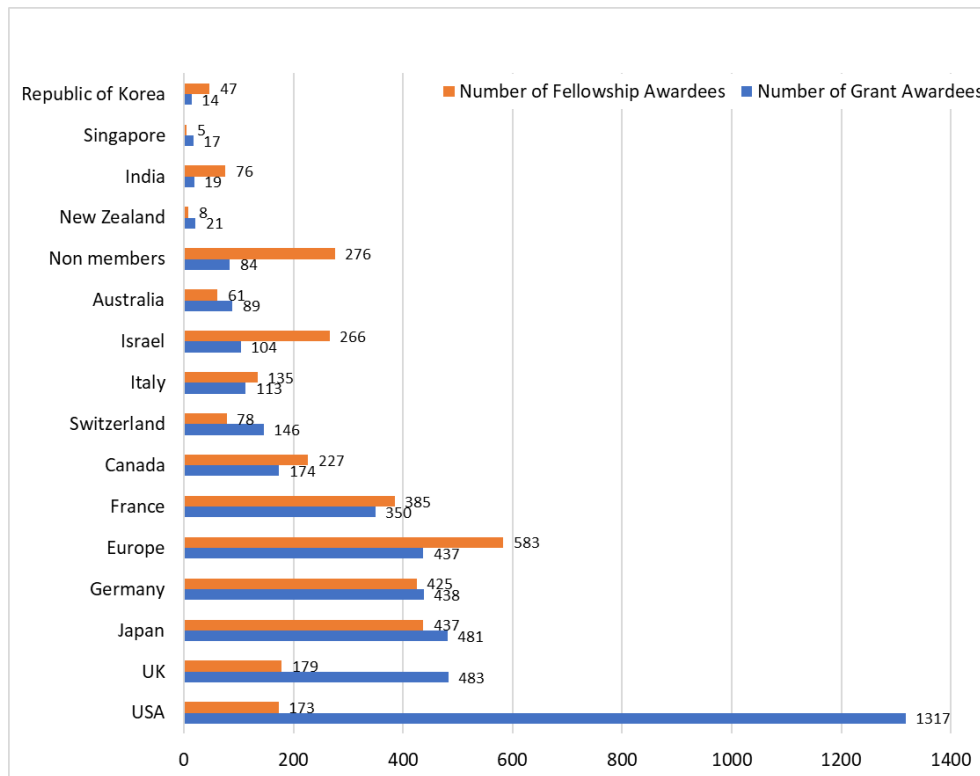


An HFSP award is a distinction of excellence for any scientist. But beyond the award it is the opportunity to “rub shoulders” with scientists from different fields that distinguishes HFSP from many other programs. International research collaborations supported by HFSP not only allow the teams to investigate a fundamental problem but also to bridge the divide between basic and applied research (<https://www.hfsp.org/hfsp-news-events/pure-diversity-display>). **Therefore, it is not uncommon that an HFSP award draws further support from other funding agencies such as the European Research Council.**

Team science is often a key to breakthrough discoveries, but HFSP also places a strong emphasis on nurturing talented individuals that have the potential to be future science leaders. The HFSP Fellowship Program, while highly competitive, offers young scientists a jump-start for a stellar career in science.

Europe belongs to the group of HFSP Members that has received HFSP awards every single year for the entire duration of their membership.

A comparison of HFSP Members on a continental scale shows that Europe is well placed in terms of its success in the main HFSP programs for research grants and postdoctoral fellowships, Europe is leading all other members or countries in the latter category. **Europe would be in the leading position if awards for France, Germany, and Italy were included and would even overtake the USA.** The current trend (as shown in the graph) does not show any signs of slowing down, in particular, in light of the great promise of the new framework programme “Horizon Europe” for the future of science across the continent.

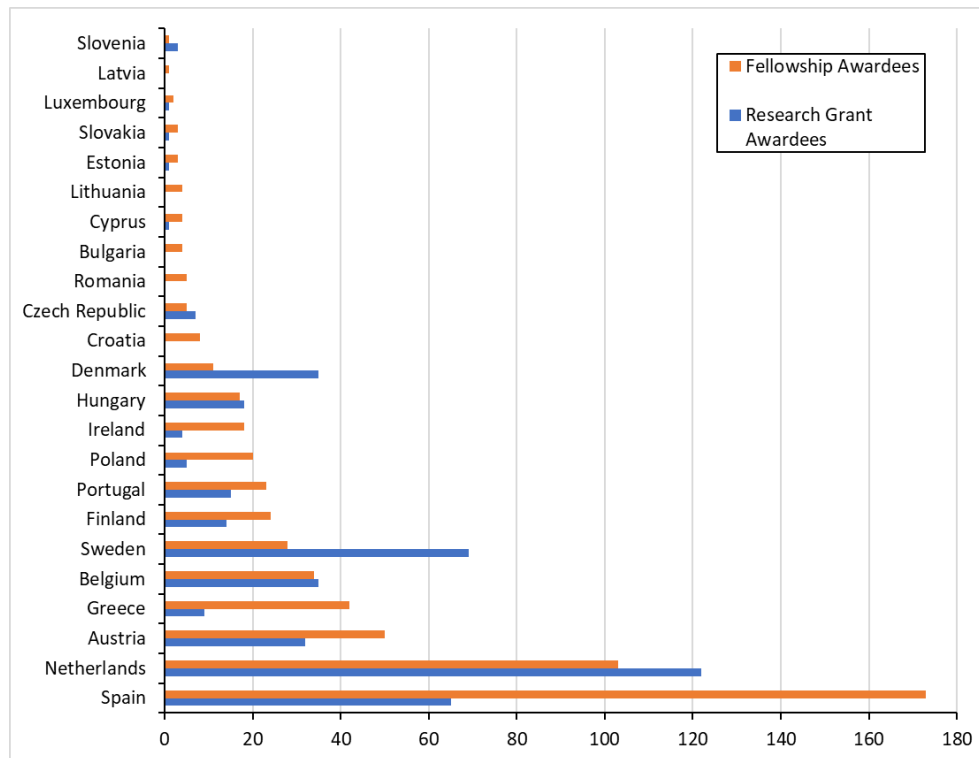


Number of HFSP grant and fellowship awardees across HFSP Members

The added value of HFSP support is clearly evident through the substantial number of awardees in both programs from non-member states indicating that international collaboration remains high on the agenda of scientists.

As can be expected there is some degree of variation among individual European countries in terms of success in HFSP programs as the critical mass for frontier research is not equally distributed across Europe. Although smaller economies have gained momentum in HFSP programs, **the majority of HFSP awards is shared between Spain, the Netherlands, Austria, Greece, Belgium and Sweden** (see figure below). Europe’s strength lies in the HFSP fellowship program because it is the ideal support for young PhD holders to gain experience abroad and not having to worry about their subsistence for three years.

Only in Denmark, Sweden and the Netherlands do HFSP research grant awardees outnumber the HFSP fellowship awardees significantly, whereas in Spain, the HFSP fellowship program has developed into a key support mechanism for young PhD holders to carry out research abroad.



Nationality distribution of European HFSP grant and fellowship awardees

5.1 What scientists say about HFSP awards

HFSP research grants are globally unique because they bring together a team that has never collaborated before and in which each member represents a different research field or discipline. In addition, the team has to propose a truly novel, daring research project in order to stand a chance of winning HFSP support. Hence, the selection and review processes apply high standards to identify HFSP grant projects. While HFSP support only lasts for three years, grant teams are united in their view that HFSP collaborations are unique and long lasting.

A toolbox for innovation: HFSP research grants

- International collaboration allows the team to go beyond what is possible in a single laboratory and often is considered to be the only way to develop new approaches with colleagues in other fields
- The “HFSP set-up” is a key ingredient for exciting and unexpected results
- The grant outcome triggers follow-up support from other funding agencies
- HFSP collaboration enables discoveries of novel mechanisms and functions related to the field of study
- The projects lead to new understanding that provides answers to critical questions, which in turn advance the field or discipline
- HFSP networks continue to thrive and even expand after the grant, with the possibility for exchange of staff, in particular younger scientists, between participating laboratories in other countries
- The interdisciplinary character of the HFSP research grants is often the only way to combine and integrate approaches from neighboring disciplines/research fields

The post-PhD period is a critical step for early career researchers, when they are required to immerse themselves in a topic that will be at the centre of their attention and work for years to come. Therefore, HFSP fellowships provide an open field where young scientists can follow their interests and work at the world's best research institutions in any country. Undoubtedly, the HFSP fellowship increases the "appetite" for further research and learning new techniques, but also strongly impacts the careers of scientists following their HFSP award.

The HFSP career boost

- HFSP fellowships provide the foundation for an independent career
- HFSP fellowships enable immersion in the international scientific community
- HFSP fellowships help to move into new research fields by transition through a deep learning curve
- HFSP fellowships bring prestige and reputation
- The HFSP Awardees Meeting is an important breeding ground for new research ideas and international collaborations
- HFSP fellowships enable exposure to emerging technologies and research topics
- A three-year fellowship is much more realistic for carrying out a research project
- HFSP fellowships provide a stepping-stone for additional funding to start an independent laboratory in the home country

5.2 Prizes and awards

Not only has the Program received high acclaim and praise for its outstanding contribution to scientific breakthrough discoveries, but the scientists funded by HFSP have themselves been recognized for their seminal work that in many cases has led to important tangible outcomes. HFSP awardees have claimed 28 Nobel Prizes in the last 30 years (<https://www.hfsp.org/awardees/nobel-prizes-hfsp-awardees>).

The outcome of the independent HFSP reviews and the recognition of HFSP funded scientists provide unequivocal evidence of the outstanding quality of the contribution of HFSP to research and technical development, both of which add significant value to society. HFSP awardees continue to receive scientific awards and prizes. Since the beginning of the Breakthrough Prize in Life Sciences, HFSP awardees were among the winners every single year. The same applies to the Kavli Prize in Neuroscience, which was awarded to an HFSP awardee every year since its inception.

Prizes for European HFSP awardees*		
2013 Breakthrough Prize in Life Sciences	Titia DE LANGE	Netherlands
2013 Breakthrough Prize in Life Sciences	Hans CLEVERS	Netherlands
2014 Canada Gairdner International Award for Biomedical Research	Titia DE LANGE	Netherlands
2011 Grete Lundbeck European Brain Research Foundation Brain Prize	Tamás FREUND	Hungary
2013 Grete Lundbeck European Brain Research Foundation Brain Prize	Gero MIESENBÖCK	Austria
2017 Grete Lundbeck European Brain Research Foundation Brain Prize	Raymond DOLAN	Ireland
2018 Grete Lundbeck European Brain Research Foundation Brain Prize	Bart DE STROOPER	Belgium
2019 Louis-Jeantet Prize for Medicine	Botond ROSKA	Hungary

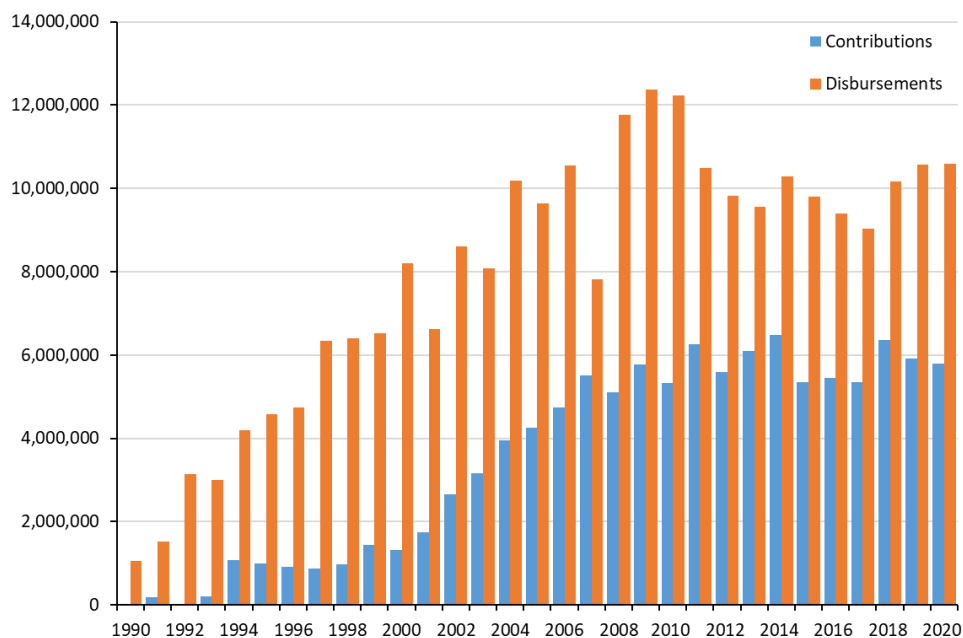
** The table presents major prizes for HFSP awardees from countries that are represented by the membership of the European Commission in HFSP, and therefore it does not include information about prizes for scientists from France, Germany and Italy, that are members in their own right.*

6 HFSP invests in Europe's scientific future

The European Commission membership of HFSPO assures that scientists from European countries that are not members of the G7 have access to HFSP support. Since the beginning of HFSP operations, **the European Commission has provided annual contributions in excess of 108 million USD.**

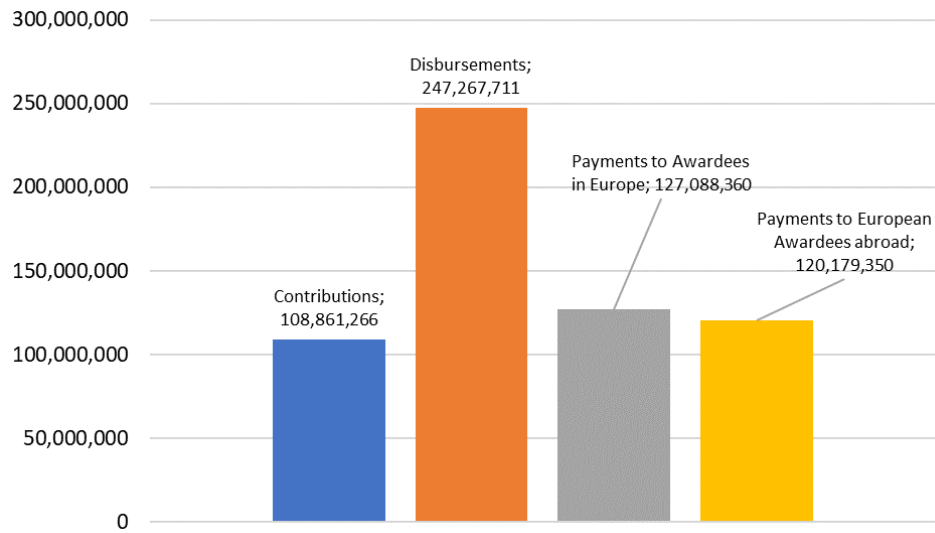
Scientists from Europe are immensely competitive and therefore it is not surprising to see that they are so successful in gaining HFSP support on a regular basis. Their trajectory of success remains remarkable.

Overall disbursements by HFSP to European scientists working abroad or in Europe totals to more than 247 million USD. European scientists embraced HFSP support early on and by the mid-1990s support to European scientists has surpassed annual contributions by more than a factor of 3. Both contributions and disbursements increased during the first two decades but have since stabilised, with disbursements maintaining a level of about 10 million USD annually since 2009.

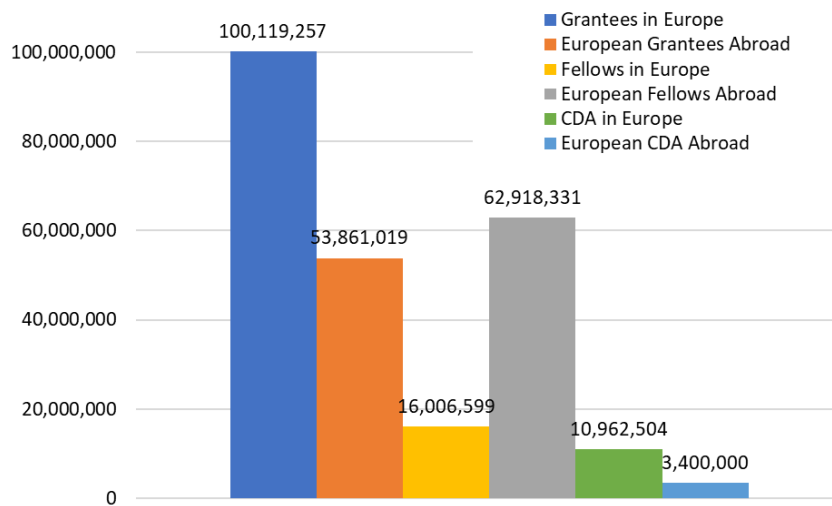


Annual contributions by the European Commission to the HFSP budget and disbursements by HFSP to support European scientists.

Unlike anywhere else in the world, for citizens of Europe there are no more borders; being mobile and experiencing life in other countries is a basic principle of the European lifestyle. Scientists, at any stage of their career, relish the opportunity to carry out their research in other countries and this is evident looking at the distribution of HFSP support by program category. Of the total payments to support HFSP awardees working in Europe or HFSP European scientists working abroad, some 52% supported the former category (~ 127 million USD) and the remaining 48% went to the latter category.



Total amounts of contributions by the European Commission to the HFSP budget and total disbursements by HFSP to support European scientists with the breakdown of payments to European HFSP awardees in Europe and abroad.



Total amounts of HFSP support to European grant and fellowship awardees working in Europe and abroad.

The readiness to be mobile, however, becomes clearly apparent on a closer look at HFSP postdoctoral fellows. Only about a quarter of the support is paid to HFSP fellows working in European research laboratories (~ 16 million USD) whereas the vast majority of HFSP fellows moves outside of Europe for their HFSP fellowship experience amounting to about 62 million USD. The situation is the opposite for HFSP research grants. Most of the support has been paid to heads of laboratories in Europe (~100 million USD) compared to European scientists running their laboratories abroad.



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