



ANNUAL REPORT

1 April 2022 – 31 March 2023



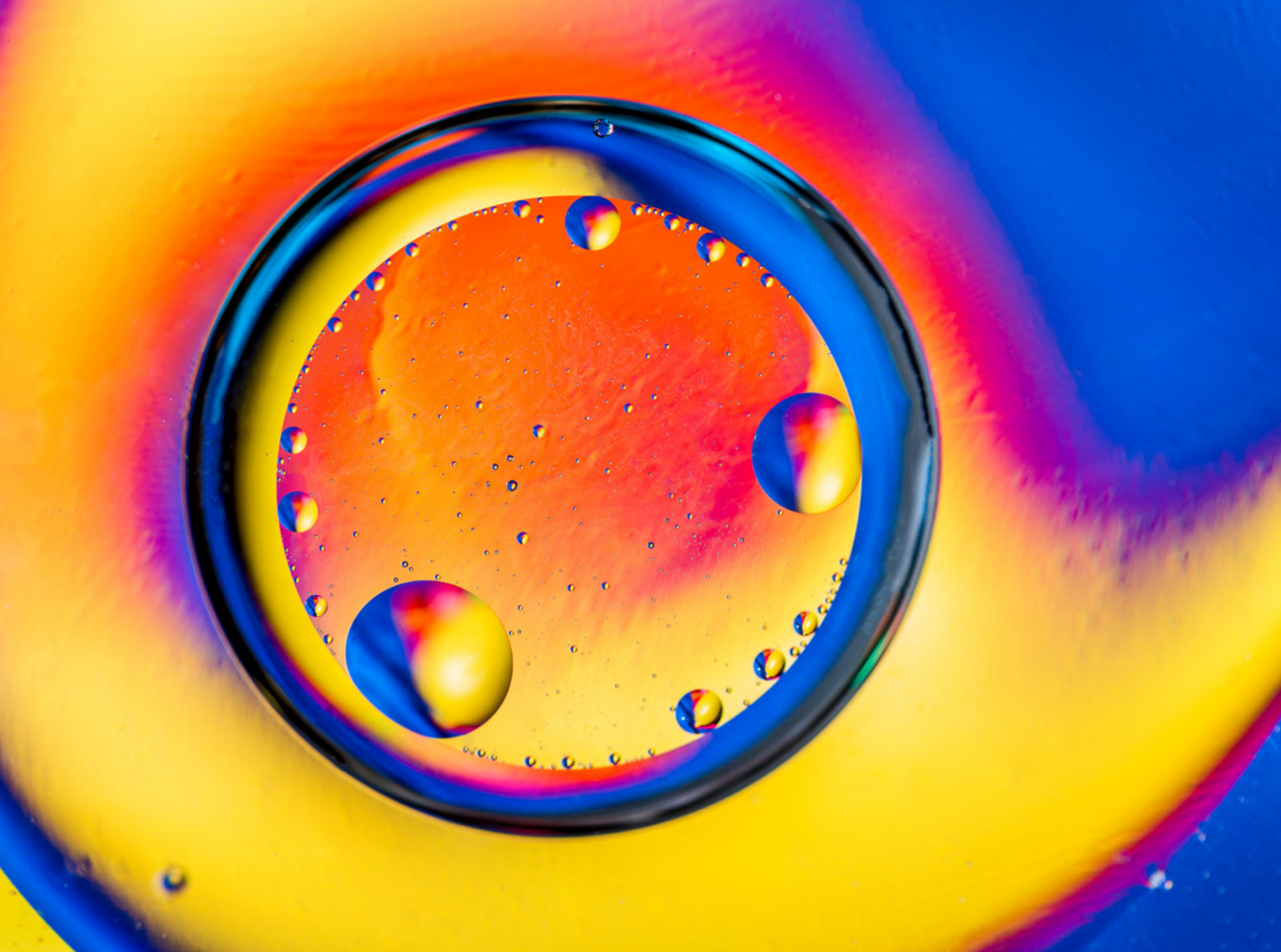
International

**Human Frontier
Science Program**

Organization

INTERNATIONAL HUMAN FRONTIER SCIENCE PROGRAM ORGANIZATION

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, Norway, Singapore, South Africa, Switzerland, the United Kingdom of Great Britain and Northern Ireland, the United States of America, and the European Commission. Since 1990, nearly 8,000 researchers from more than 70 countries have been supported. Of these, 28 HFSP awardees in 32 years have gone on to receive the Nobel Prize.



**The following documents are available
on the HFSP website www.hfsp.org:**

- Joint Communiqués (Tokyo 1992, Washington 1997, Berlin 2002, Bern 2004, Ottawa 2007, Canberra 2010, Brussels 2013, London 2016, Tokyo 2019):
<https://www.hfsp.org/about/governance/membership>
- Statutes of the International Human Frontier Science Program Organization:
<https://www.hfsp.org/about/governance/hfspo-statutes>
- Guidelines for the participation of new members in HFSPO:
<https://www.hfsp.org/about/governance/membership>
- General reviews of HFSP (1996, 2001, 2006-2007, 2010, 2018):
<https://www.hfsp.org/about/strategy/reviews>
- Lists of 2022 awards:
<https://www.hfsp.org/awardees/newly-awarded>
- Previous lists of awards, including titles and abstracts:
<http://www.hfsp.org/awardees/awards>

OUR SHARED VALUES

Supporting scientific excellence at the frontier of life science has been the overarching mission of HFSPPO since its very first days. HFSPPO takes pride in its distinct culture which contributes to scientific excellence through high-risk, high-gain research that is paradigm shifting, interdisciplinary, and collaborative at an international level for the benefit of all humankind.

This culture is firmly grounded on shared values of diversity, equity, inclusion, open science, and sustainability.

HFSPPO is committed to the highest ethical standards of integrity, accountability, independence and impartiality, transparency, respect and professional conduct, and promotes these standards in the conduct of research.

Our culture and ethical standards are closely intertwined with fundamental human rights and mutual openness, which are at the core of innovation and responsible, inclusive research and research support.

On this basis, the Scientific Program supports and nurtures individual scientists at all stages of their career and the scientific community at large. It is the collective creativity of this community that drives the Research Program in this service of society.

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In addition to the annual report, HFSP will also publish a Science Digest presenting research highlights from HFSP research grant and fellowship awardees, together with summaries of recently awarded projects.

The “HFSP Science Digest 2022” will be published as a separate document.

Introduction





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PRESIDENT'S MESSAGE



Photo credit: Christophe Peus

Shigekazu NAGATA
President of HFSP

When I think about the most accomplished pure scientists I have known, and the truly transformative theories they have introduced, the single-most influential factor in their success has been the ability to consider issues from multiple perspectives.

Yet, of all the aspects that go into the education of a scientist, this part, the process of conceiving and developing truly novel perspectives, is the most difficult to impart to someone just getting started in their career.

One way early career scientists can develop these faculties is to pursue a fellowship abroad that involves working in a laboratory with scientists from countries, who use different approaches, start with other assumptions, and likely even look at results somewhat differently. A subtle shift occurs when we immerse ourselves in culturally different situations and live and work among people who speak other languages. One's daily activities are no longer deeply rooted in familiar contexts; one must reach for creative solutions to solve everyday challenges. Working and living this way for a year

or two, one develops courage, a willingness to take risks, and a greater comfort level with experimental mindsets. This is needed to envision new theories and design research, the true frontier in nature that can open new horizons in scientific thought and discovery.

But this is preparation one cannot obtain through books – only life experience can unlock the door to these abilities. In the 1970s, research in recombinant DNA started, which interested me very much. But Japan did not yet have the facilities for this work. One of my mentors introduced me to Charles Weissmann, a molecular biologist at the University of Zürich, one of the pioneers in this field. I was fortunate to work as a postdoctoral fellow in his lab from 1977 to 1981.

In Dr. Weissman's laboratory, we succeeded in isolating human interferon cDNA. Our work provided the scientists with the interferon gene and pure interferon protein. Many scientists started to work with interferon, which fundamentally changed what scientists understood about interferon. I now learned that the

“Science is a fan because things that differ from what you think or anticipate emerge. It’s interesting because you don’t know where or how to jump.”

Shigekazu NAGATA, published in *Nature*.

interferon system is essential in preventing COVID-19 infection.

My experience working with Dr. Weissmann in Zürich opened new ways of thinking and fascinating research opportunities that shaped my career in important ways. Working with someone who is brilliant and accomplished is motivating and invigorating. I believe the experience of working abroad and taking a few risks brings out new qualities in a person that can become important strengths.

I knew moving to Switzerland would involve considerable cultural change, and I was curious about the differences. Zürich is near the border with Germany, and just a train ride to France, Lichtenstein, Austria, and Italy, so I grew accustomed to hearing many languages and accessing countries that varied significantly culturally. Likewise, the University of Zürich, with students from many different countries, was very different from my alma mater, the University of Tokyo, where almost all students are Japanese.

Living and working in another country broadens a person’s

perspective, which is one of the reasons I recommend that early career scientists apply for and pursue international postdoctoral fellowships, such as the HFSP Cross-Disciplinary and Long-Term Fellowships. I recommend this as President of HFSP and as a senior biochemistry and immunology scientist who has mentored dozens of early career scientists. When I look at the generation of younger scientists developing their research capabilities, I see not only what they can do now, but I am aware of their potential – what they could become if they seize their opportunities.

One of the biggest challenges that young scientists of today face is the temptation of safety. When times are economically secure, staying close to established professional connections and working through familiar channels is natural. It is very tempting to accept the job opportunity your mentor offers or apply for a grant to expand work already underway. But individual scientists need more than safety to develop real intellectual strength and investigative

depth. Indeed, to ensure the vitality of the life sciences as a discipline, the next generation of scientists must learn how to be pioneers. As the essential work of HFSP is opening new frontiers, our fellowships offer early career scientists extraordinary opportunities to delve deeply into pure science and hone their powers of investigative thinking by working with researchers in the life sciences and laboratories worldwide.

SECRETARY-GENERAL'S MESSAGE



Pavel KABAT

Secretary-General of HFSP

As I reflect on 2022, my first full year as Secretary-General for HFSP, much of my effort and concentration has focused on a key aspect of our lives as scientists, funders, and science officials, one that is seldom discussed, namely our collaboration and social cohesion as the HFSP community.

When HFSP-supported scientists describe how they chose to make research their life's work, they talk about curiosity-driven investigations, the opportunity to make discoveries, and stretch the frontiers of their imagination. This way of life and work is truly remarkable and rewarding, a pure ideal, if ever there was one. But in truth, we are able to pursue ground-breaking research because of our "social contracts" with each other.

What do I mean by this? Social contracts are those agreements, sometimes articulated, but often unspoken, whereby people work together and relate to each other. They may be spelled out in detail like a charter, or as intuitive as a mindset.

For example, HFSP is based on a core sensibility that scientific advancement represents a common good for humanity and that frontier, scientific knowledge is an important investment. This represents a basic truth and a shared value system for our community. Our Member countries embrace this view to the point their representatives who serve on HFSP governance bodies, their governments, and their taxpayers entrust us with a precious directive: to investigate as we see fit.

When you think of it, there are very few positions and opportunities in the public sector where people are supported to dig deep and explore widely with no guarantees a priori of finding gold. That is because our Member countries provide 'the guarantee.' In other words, the support of HFSP Members and our willingness to work collaboratively is what makes our investigations possible. This is part of what I mean by our 'social contracts.'

Over time, the high-risk, high-reward ambitions of HFSP's frontier research have also paid handsome dividends to Members in the way of discoveries in basic life science that have paved the way for the Age of Biology, led to outstanding innovations that proved essential to evolving our approaches to medicine and

public health, and developed a mutual trust among Members and scientists that reminds us that working together through international collaboration creates inestimable value.

This year, I traveled widely to meet with hundreds of HFSP scientists, representatives of our Member countries, and government officials. My goal was to deepen our ties with one another, to have conversations that celebrate our successes, discuss how life science is changing and which frontiers are opening up. In my travels, I visited many countries, laboratories, and universities to ensure that the HFSP Secretariat is well familiar with Member countries' priorities, needs, strengths, and challenges. As I traveled and met people, it became clear that HFSP's success depends on how cohesive we are as an organization and a community: the degree to which we understand, accept, trust, and accommodate each other.

Member countries create our 'safety net' at many levels, whether that be through financial contributions, encouraging their science leaders to contribute time and expertise to our HFSP governing bodies, or hosting HFSP research and fellows at laboratories with state-of-the-art facilities. Literally, Members make available their resources for the good of the whole community that is HFSP.

As part of this effort, in 2022, HFSP began reviewing our

Shared Values with an eye to becoming more diverse and inclusive, meaning accelerating involvement of scientists who have previously been under-represented in the frontier life science enterprise due to a variety of biases and prejudices; and this includes science communities that have excellent research, but which, for a variety of reasons, have been isolated from participating in the global scientific enterprise. One can think of unconscious bias and prejudice as a breakdown of the social contracts among people. We are also inviting new Member countries that share our values, to join HFSP, an effort that is essential to our long-term vitality and to the evolving nature of science as a discipline. Norway and South Africa are now HFSP Member as of the beginning of 2023, and my warmest welcome to both!

Becoming more inclusive will evolve our social contracts still further. Scientists working in the field and in laboratories may find their teams now include a greater diversity of experience and a wider range of perspectives than perhaps in the past. Likewise, with more Member countries, the responsibility of holding the net is more equitably distributed, making it more secure for the future. Including more Member countries and people is essential in a world that in the last years has been rocked by the COVID 19 pandemic, war in the Ukraine and economic volatility.

In 2022, we have also undertaken dedicated efforts to build a Strategic Plan for our future, from 2024-2032, and this deep-

dive required considerable effort, debate, discussions, and willingness to make compromises – together. We often talk about international collaboration in terms of our science teams, but just as vital is the international cooperation that leads to wise governance for HFSP. We are looking forward to sharing the new Strategic Plan 2024 – 2032 soon, and are very enthusiastic about the future horizons for HFSP.

When the G7 nations, together with the European Commission, created HFSP back in 1987, they created a flexible organization with a clear purpose and a unique niche to discover and explore frontier life science research. What has emerged over time is, yes, extraordinary research, but also clarity that our ability to continue is also an experiment in frontier life science, and perhaps in the overall public science enterprise as a whole. Can we evolve, adapt, plan, and work wisely together?

What my missions this year have shown me is while the curiosity of the mind may have led me and others into science, the ability to do ground-breaking, high-risk high-reward scientific research in a dedicated, long-term capacity depends on our strong bonds and trust with each other. And I am happy to report that those connections are alive and well!

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INTRODUCING

HFSP

The International Human Frontier Science Program Organization is an international cooperation in life science research supported by the world's leading scientific countries. It promotes fundamental research in the life sciences with special emphasis on novel and interdisciplinary research, international and, in particular, intercontinental collaboration and support for early career investigators.

HFSP funding complements national programs to enable collaborations in a scientific landscape that changes fast. Novel approaches from different disciplines hold great promise to address the most important problems in understanding complex life. The challenge for all scientists is to look beyond their original expertise and to broaden their horizons by working with collaborators they have never interacted with before and by moving into new fields of research. HFSP is at the forefront of such interdisciplinary, collaborative research. Through its different funding schemes, it supports frontier, potentially transformative 'out-of-the-box' proposals and encourages applications for high-risk, high-reward projects. Successful projects challenge existing paradigms by using novel approaches and techniques; they address important problems and barriers to progress in the field.

HFSP supports research into the complex mechanisms of living organisms, ranging from the biomolecular level to the whole organism and its physiology and behavior. The life sciences have emerged as a leading scientific area in which approaches from physics, mathematics, chemistry, computer science and engineering converge to solve biological questions. HFSP aims to support frontier research by involving scientists from outside the life sciences as part of research collaborations and as postdoctoral fellows. To this end, the Program Grants and Early Career Grants are specifically geared to fostering interactions between scientists from different disciplines and this is a major factor in the review of applications for these programs. In this context, HFSP supports Cross-Disciplinary Fellowships to equip young scientists from outside biology with the skills needed to tackle problems in the life sciences.

Since its establishment in 1989, HFSP has demonstrated the value of creating a framework for competitive, collaborative, international research of the highest caliber and for providing early career scientists with the opportunity to emerge as talented researchers capable of shaping the science of the future.

Since 1990, more than 1200 research grants involving over 4300 scientists, and more than 3400 fellowships have been awarded. Researchers from more than 70 countries have received HFSP funding so far.

HFSP implements its Program through the following mechanisms of research support, details of which can be found in the subsequent chapters:

RESEARCH GRANTS

- **Early Career Grants** – for interdisciplinary teams of early career researchers who are within the first five years of their first independent position and located in different countries.
- **Program Grants** – for interdisciplinary teams of researchers in different countries at any stage of their careers.

HFSP supports the next generation of researchers, who are in the strongest position to open new avenues of research through the fellowship program and Early Career Grant program. Program Grant teams are also encouraged to include early career scientists with the result that a significant number of scientists under the age of 40 are included in awarded teams. Taken together, these early career researchers are awarded approximately 70% of annual HFSP funds.

POSTDOCTORAL FELLOWSHIPS

- **Long-Term Fellowships** – for early career life scientists within three years of obtaining their PhD who wish to broaden their scientific experience in a foreign laboratory.
- **Cross-Disciplinary Fellowships** – specifically for scientists with a PhD in non-biological disciplines to bring new perspectives to research in the life sciences.

HFSP is governed by the Board of Trustees, which is composed of appointees from the HFSP Members, which currently include: Australia, Canada, France, Germany, India, Israel, Italy, Japan, New Zealand, Norway, the Republic of Korea, Singapore, South Africa, Switzerland, the United Kingdom of Great Britain and Northern Ireland, the United States of America, and the European Commission. These appointees are selected from the national scientific organizations that coordinate with HFSP's Secretariat and are referred to as Management Supporting Parties, or MSPs.

Members of the HFSP Council of Scientists are nominated by the HFSP Members. They provide scientific advice to the Board of Trustees and select the winners of the HFSP Nakasone Award.

The Board is supported by the HFSP Secretariat, which is located in Strasbourg, France, and directed by the Secretary-General. The legal basis for HFSP is as a not-for-profit association located in Strasbourg (Grand Est), France. The Member countries support HFSP through voluntary contributions that are agreed upon at the Triennial Conference of HFSP Members.

The background is an abstract composition of vibrant blue and orange colors. It features numerous water droplets of various sizes, some appearing as bright highlights against the darker blue. The colors blend into each other, creating a sense of depth and movement. A solid white horizontal line is positioned below the main title.

Chapter 1

Research Grant Program



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1.0

KEY FIGURES

- **34 Research Grants**, including 25 Program and 9 Early Career, were awarded in March 2023 involving 107 investigators.
- During this award cycle, **the success rate for Letters of Intent submitted in March 2022 was 5.6% for Program and 6.5% for Early Career**. Higher success rates can be attributed to relatively lower numbers of submissions.
- **32 awardees (30%) are female scientists** working in 16 different countries on five continents.
- **Research topics range from the molecular understanding of muscle development, protein multifunctionality and de novo emerging micropeptides to the cognitive processes underlying self-medication of immune-challenged bats, the neural basis of early language development and the evolution of iridescent colours.**
- To understand how Archaea protect their hosts from viral infection is the focus of a study in symbiotic relationships that will combine expertises in genomics, cell biology, virology, high-resolution microscopy and mathematical modelling. This project has a truly intercontinental Early Career team with members in the Netherlands, Australia, Japan and the USA.
- A team with members in Japan and Kenya **will study the unresolved role of fibroblasts in one of the major parasitic diseases in sub-Saharan Africa, schistosomiasis.**
- A project based in India, Canada, the UK and Brazil **combines comparative genetic, olfactory, virological and immunological analyses in an evolutionary modelling framework to understand how stimulation of the mosquito olfactory system by human odours can affect mosquito vector competence to arboviruses.**
- A project aiming to understand **how diet influenced the evolution of our ancestors** will make use of new advances in isotopic measurements possible through mass spectrometry and combine analytical chemistry, isotope analytics, and paleoanthropology in investigations of fossil tooth enamel.

1.1

AIMS OF THE HFSP RESEARCH GRANTS

HFSP supports frontier research in the life sciences through two types of research grants:

- **Research Grants - Program** are awarded to teams of two to four scientists at any stage of their careers who embark upon a new collaborative project.
- **Research Grants - Early Career** (previously known as Young Investigator Grants) require team members be within five years of obtaining an independent position and not more than 10 years after completing their PhD.

Both types of HFSP research grants are awarded to interdisciplinary teams of two to four scientists working in different countries – and preferably different continents. The emphasis is on newly built teams, in which each member brings a distinct and unique approach to the proposed project. Major progress in answering basic questions in the life sciences requires interdisciplinary approaches, with new combinations of novel technologies and innovative theoretical concepts. This is seen in the strong participation of scientists from disciplines outside the traditional life sciences, such as physics, chemistry, geology, material science, mathematics, nanoscience or psychology, in awarded HFSP research grants. HFSP projects are based on the outstanding competence of the scientists, their innovative ways of thinking, and their willingness to take the risk to step outside the limits of their traditional research area and build new teams. These interdisciplinary collaborations have opened up new approaches for understanding the complex structures and regulatory networks that characterize living systems.

1.2

SELECTION OF HFSP RESEARCH GRANTS

For the competition launched in March 2022, HFSP received 589 eligible letters of intent. Following the two-step peer review process, the HFSP Board of Trustees approved 34 awards, 25 to Program Grant teams and 9 to Early Career teams, in March 2023.

Table 1.1

Breakdown of the Two-step Review Process for HFSP Research Grants

	Program Grants	Early Career Grants	Total
Number of eligible letters of intent*	450	139	589
Number of full applications	57	24	81
Number of awarded projects	25	9	34
% of awarded projects, based on letters of intent	5.6	6.5	5.8
% of awarded projects, based on full applications	43.9	37.5	42.0
Number of members per awarded team, mean (range)	3.2 (2-4)	3.0 (2-4)	3.15
Cumulative total per year (in USD millions)	9.60	2.76	12.36

*7 submitted LOIs were ineligible and are not counted here.

Figure 1.1

The figure Shows the Development of Submitted Letters of Intent and Awards as Well as Success Rate over the Last 10 Years

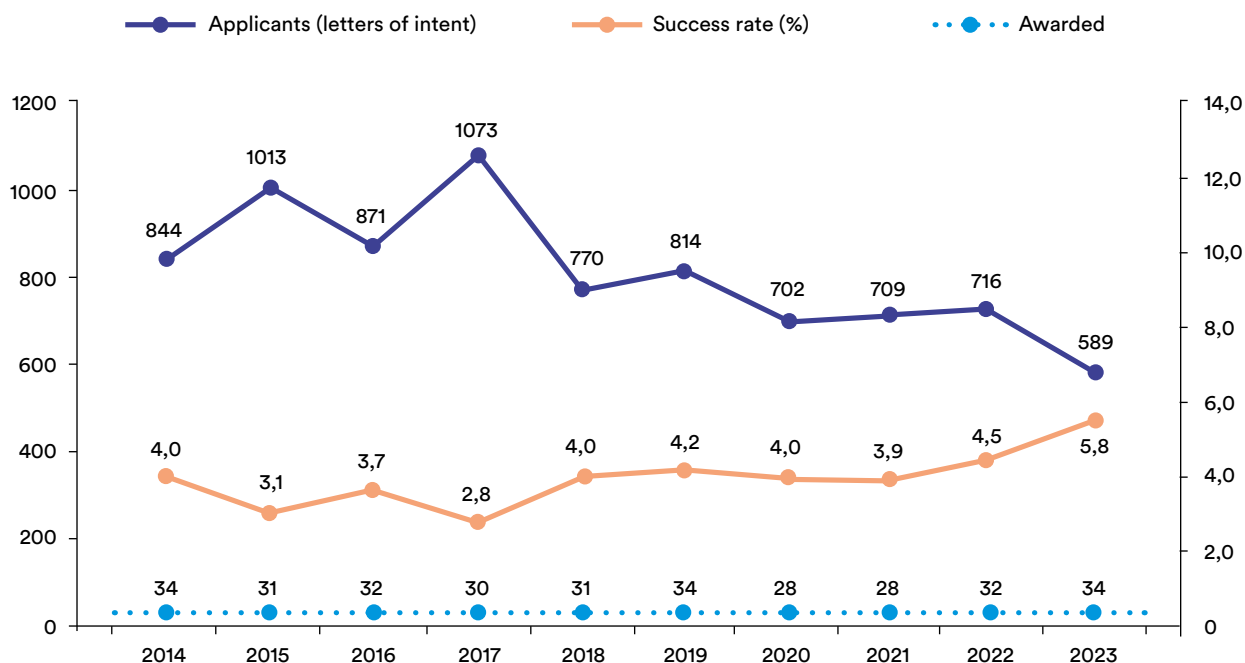


Table 1.2

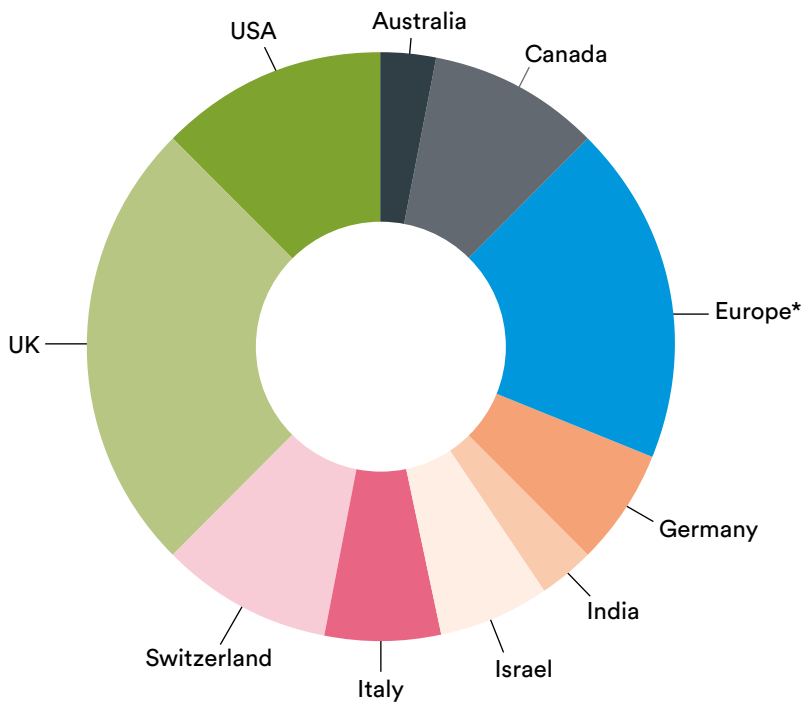
Gender Distribution Among Applying and Awarded Teams Differs Between the Program and Early Career Grants. Table Provides Information on All Team Members, Thus, Principal Applicants and Co-applicants

	Letter of intent		Awarded grants	
	Program	Early Career	Program	Early Career
Number of female scientists	415 32.4%	131 35.8%	23 29.1%	9 34.6%
Number of male scientists	866 67.6%	234 64.1%	56 70.9%	17 65.4%
Total number of scientists	1304*	368*	80	27

* Gender information was not provided by 26 applicants (23 Program & 3 Early Career).

** Gender information was not provided by 2 awardees (1 Program & 1 Early Career).

Figure 1.2
Countries Where Awardees Are Working



Principal investigators

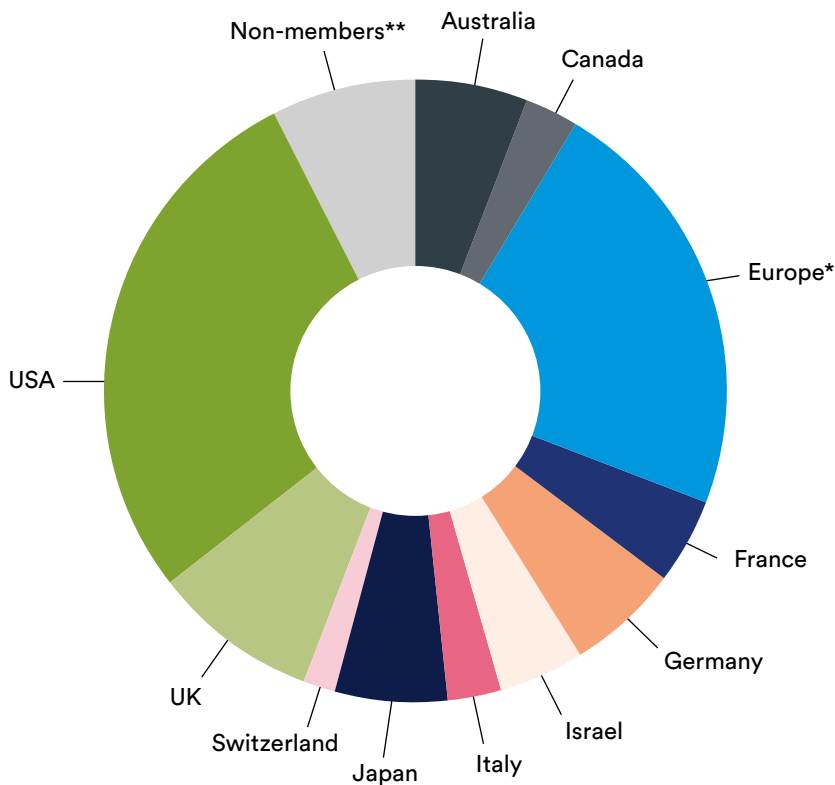
The principal investigators located in other countries of Europe have their laboratories in the following countries:

Austria 1, Denmark 2, Greece 1, the Netherlands 3, Portugal 1

Co-investigators

The co-investigators located in other countries of Europe have their laboratories in the following countries:

Belgium 2, Czech Republic 1, Denmark 3, the Netherlands 1, Portugal 1, Slovenia 1, Spain 1 and in countries that are not members of the organization: Brazil 1, Colombia 1, Kenya 1 and Panama 1.



1.3

HFSP RESEARCH GRANT REVIEW COMMITTEE



Tomomi SHIMOGORI
Chair Research Grant Review
Committee

NON-REVIEWING CHAIR

- Tomomi SHIMOGORI, RIKEN Center for Brain Science – BSI, Wako, Japan

AUSTRALIA

- Robert PARTON, University of Queensland, Brisbane

CANADA

- Stephen W. MICHNICK (Deputy Chair), University of Montreal

EUROPEAN UNION

- Alessandra CAMBI, Radboud University Medical Centre, Nijmegen, The Netherlands
- Sebastian HAESLER, Catholic University of Leuven (KU Leuven), Belgium
- Tim VOGELS, Institute of Science and Technology Austria

FRANCE

- Aude PANATIER, Neurocentre Magendie, Bordeaux
- Marie-France SAGOT, University Claude Bernard, Lyon

GERMANY

- Michael LENHARD, University of Potsdam, Potsdam

INDIA

- Rashna BHANDARI, Centre for DNA Fingerprinting and Diagnostics (CDFD), Hyderabad
- Uma RAMAKRISHNAN, NCBS - Tata Institute of Fundamental Research, Bangalore

ISRAEL

- Roy BAR-ZIV, Weizmann Institute of Science, Rehovot

ITALY

- Antonio CELANI, The Abdus Salam International Center for Theoretical Physics (ICTP), Trieste

JAPAN

- Jun KITANO, National Institute of Genetics, Mishima

REPUBLIC OF KOREA

- Mi Sun JIN, Gwangju Institute of Science and Technology, Gwangju
- Tae-Young ROH, Pohang University of Science and Technology, Pohang

NEW ZEALAND

- Jasna RAKONJAC, Massey University, Palmerston North

SINGAPORE

- Hongyan WANG, Duke-NUS Medical School, Singapore

SWITZERLAND

- Sebastian MAERKL, ETH Zürich

UNITED KINGDOM

- Tom BADEN, University of Sussex, Brighton
- Timothy SAUNDERS, University of Warwick, Coventry

UNITED STATES OF AMERICA

- Karl MUNGER, Tufts University School of Medicine, Boston
- Anne PRINGLE, University of Wisconsin, Madison
- Jennifer ROSS, Syracuse University, Syracuse

DELEGATE FROM THE COUNCIL OF SCIENTISTS

The HFSP Council of Scientists is responsible for overseeing the peer review process of HFSP funding programs. Each year a Council member participates in the review committee meetings as an observer with the role to monitor due diligence of the proceedings.

- Masahide KIKKAWA, The University of Tokyo, Japan

1.4

RESEARCH GRANT AWARDEES LISTS

Research grants awarded in March 2023 (to be initiated in FY 2023)

Nationality is in parentheses when different from the country in which the lab is located.
Information reflects status at time of award.

1.4.1 RESEARCH GRANT – PROGRAM

When the going gets tough: Trans-kingdom spore dormancy and revival mechanisms across scales

BALASUBRAMANIAN Mohan	Warwick Medical School University of Warwick Coventry	UK (India)
BEN YEHUDA Sigal	Dept. of Microbiology and Molecular Genetics The Hebrew University of Jerusalem	Israel
JANSHOFF Andreas	Dept. of Chemistry University of Göttingen	Germany
O'SHAUGHNESSY Ben	Dept. of Chemical engineering Columbia University New York	USA (UK)

SELFCURE: Evolutionary and cognitive processes underlying self-medication of immune-challenged bats

BECKER Daniel	Dept. of Biology University of Oklahoma Norman	USA
PAGE Rachel	Gamboia Labs Smithsonian Tropical Research Institute Ancón	Panama (USA)
SIMON Ralph	Behavioural Ecology and Conservation Lab Nuremberg Zoo	Germany

Autonomous evolution of synthetic cells under non-equilibrium conditions

BRAUN Dieter	Dept. of Physics Ludwig Maximilian University Munich	Germany
GÖPFRICH Kerstin	MPI for Medical Research Heidelberg	Germany
MATSUURA Tomoaki	Earth-Life Science Institute Tokyo Institute of Technology Meguro-Ku	Japan

‘New Kids on the Block’: How DeNovo emerged micropeptides rewire cellular networks

CARVUNIS Anne-Ruxandra	Dept. of Computational and Systems Biology University of Pittsburgh	USA (France)
BORNBERG-BAUER Erich	Faculty of Biology, University of Münster	Germany (Austria)
BRUN Christine	Dept. of Theories and Approaches of Genomic Complexity, Inserm - Provence Côte d’Azur, Marseille	France

Physics goes wild: studying the evolution of iridescence and its perception in Amazonian butterflies

DEBAT Vincent	Origins and Evolution National Museum of Natural History, MNHN Paris	France
BELUŠIĆ Gregor	Dept. of Biology University of Ljubljana	Slovenia
BRISCOE Adriana	Dept. of Ecology and Evolutionary Biology University of California, Irvine Irvine	USA
GIRALDO Marco	Institute of Physics University of Antioquia Medellin	Colombia

From disorder to order: mechanism of specialised assemblies formation essential for muscle function

DJINOVIC-CARUGO Kristina	Dept. of Structural and Computational Biology, Max Perutz Labs, University of Vienna	Austria (Slovenia)
HINSON John	Dept. of Medicine University of Connecticut, Farmington	USA
ODA Toshiyuki	Dept. of Anatomy and Structural Biology University of Yamanashi	Japan
RIES Jonas	Dept. of Cell Biology and Biophysics EMBL-Heidelberg	Germany

Nuclei as mechanical sensors and actuators in epithelial folding

ERZBERGER Anna	Dept. of Cell Biology and Biophysics EMBL-Heidelberg	Germany
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WANG Yu-Chiun	Laboratory for Epithelial Morphogenesis RIKEN Center for Biosystems Dynamics Research (BDR) Kobe	Japan (Taiwan)
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The role of lipid physical properties for the multifunctionality of insect cuticular hydrocarbons

FEDERLE Walter	Dept. of Zoology University of Cambridge	UK (Germany)
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KANEKO Fumitoshi	Dept. of Macromolecular Science Graduate School of Science, Osaka University Toyonaka	Japan
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MENZEL Florian	Institute of Organismic and Molecular Evolution Johannes Gutenberg University of Mainz	Germany
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Evolution of protein multifunctionality

FEUDA Roberto	Genetics and Genome Biology University of Leicester	UK
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CHANG Belinda	Dept. of Ecology & Evolutionary Biology Dept of Cell & Systems Biology University of Toronto	Canada
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GOEPFERT Martin	Dept. of Cellular Neurobiology University of Göttingen	Germany
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MENON Anant	Dept. of Biochemistry Weill Medical College of Cornell University New York	USA (India)
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The architecture of photosynthesis

GEITMANN Anja	Dept. of Plant Science The Royal Institution for the Advancement of Learning McGill University Sainte-Anne-de-Bellevue	Canada
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BRODERSEN Craig	School of the Environment Yale University New Haven	USA
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DEAR John	Dept. of Mechanical Engineering Imperial College of Science, Technology and Medicine London	UK
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Understanding fundamental mechanisms governing insect cell membrane deformability

GEROLD Gisa	Dept. of Biochemistry University of Veterinary Medicine Hannover	Germany
ARIOTTI Nicholas	Institute for Molecular Bioscience Brisbane	Australia
PERRIMON Norbert	Dept. of Genetics Harvard Medical School Boston	USA

Evolution at the plant apex: identifying steps enabling a major organismal radiation

HARRISON Jill	Dept. of Biological Sciences University of Bristol Bristol	UK
BEECKMAN Tom	Dept. of Plant Biotechnology and Bioinformatics Flanders Institute for Biotechnology (VIB) Ghent	Belgium
FUJINAMI Rieko	Dept. of Science Kyoto University of Education Kyoto	Japan

Bacterial targeting of the host epitranscriptome

HARTLAND Elizabeth	Dept. of Molecular and Translational Science Monash University Clayton	Australia
ALLAIN Frédéric	Dept. of Biology Swiss Federal Institute of Technology Zürich	Switzerland (France)
HELM Mark	Institute of Pharmaceutical and Biomedical Sciences (IPBS), Johannes Gutenberg University of Mainz Mainz	Germany

Social immunity in honeybee – SoBee

JENSEN Michael	DTU Center for Biosustainability Technical University of Denmark Lyngby	Denmark
FIEHN Oliver	Genome Center University of California, Davis Davis	USA (Germany)
GALIZIA C Giovanni	Dept. of Biology University of Konstanz Konstanz	Germany

Deciphering the role of dynamics in vascular network remodeling and determination

KATIFORI Eleni	Dept. of Physics and Astronomy University of Pennsylvania Philadelphia	USA (Greece)
CORNELISSEN Annemiek	Dept. of Physics – MSC lab Paris Diderot University Paris	France (Netherlands)
JONES Elizabeth	Dept. of Cardiovascular Sciences Catholic University of Leuven Leuven	Belgium

Mapping structural and functional connectivity of the distributed sensory system in chiton armor

LI Ling	Dept. of Mechanical Engineering Virginia Polytechnic Institute and State University Blacksburg	USA (China)
BAUM Daniel	Visual and Data-Centric Computing Zuse Institute Berlin Berlin	Germany
SPEISER Daniel	Dept. of Biological Sciences University of South Carolina Los Angeles	USA

Electrogenetic control of bacterial metabolism, communication, and biofilm formation

MALVANKAR Nikhil	Dept. of Molecular Biophysics and Biochemistry Yale University New Haven	USA (India)
CRAIG Lisa	Dept. of Molecular Biology and Biochemistry Simon Fraser University Burnaby	Canada
FRANCETIC Olivera	Dept. of Structural Biology and Chemistry Institut Pasteur, Paris	France
SALGUEIRO Carlos	Dept. of Chemistry Faculdade Ciências e Tecnologia Universidade Nova de Lisboa Caparica	Portugal

Exploring the evolution and physiology of the olfactory-immune system connection

MUKHERJEE Tina	Regulation of Cell Fate Institute for Stem cell science and Regenerative Medicine (inStem) Bangalore	India
MATTHEWS Ben	Dept. of Zoology University of British Columbia Vancouver	Canada (USA)
RECKER Mario	Centre for Ecology and Conservation University of Exeter Penryn	UK (Germany)
TRINDADE MARQUES João	Dept. of Biochemistry and Immunology Universidade Federal de Minas Gerais, Instituto de Ciencias Biologicas Belo Horizonte	Brazil

Uncovering the real paleo diet: Novel isotope analytics of amino acids from fossil hominin teeth

NEUBAUER Cajetan	Institute of Arctic and Alpine Research (INSTAAR) University of Colorado Boulder Boulder	USA (Germany)
BAKKOUR Rani	Chair of Analytical & Water Chemistry Technical University of Munich (TUM) Garching	Germany (Syria)
LÜDECKE Tina	Emmy Noether Group for Hominin Meat Consumption MPI for Chemistry Mainz	Germany

Unraveling the mechanism of schistosome egg migration in a complex host environment

OKEYO Kennedy	Dept. of Biosystems Science Kyoto University Kyoto	Japan (Kenya)
OCHOLA Lucy	Dept. of Tropical and Infectious Diseases Institute of Primate Research Nairobi	Kenya

Intracellular selection and dynamics of mitochondrial ageing

OSMAN Christof	Dept. of Biology Ludwig Maximilian University Munich (LMU) Planegg-Martinsried	Germany
KRIEG Michael	Dept. of Neurophotonic and Mechanical Systems Biology ICFO – The Institute of Photonic Sciences Castelldefels	Spain (Germany)
SHRAIMAN Boris	Kavli Institute for Theoretical Physics University of California, Santa Barbara Santa Barbara	USA

Cellular and molecular basis of bilaterian symmetry

PAVLOPOULOS Anastasios	Dept. of Evolution, Development & Cell Biology FORTH Institute of Molecular Biology and Biotechnology, Heraklion	Greece
GUIGNARD Léo	Laboratoire d'Informatique et Systemes Université d'Aix-Marseille Marseille	France
XIE Liangqi (Frank)	Dept. of Cancer Biology, Infection Biology Cleveland Clinic Foundation Cleveland	USA (China)

Shiny signalling: The production, detection and neurobiological processing of brilliant colours

VAN DER KOOI Casper J.	Groningen Institute for Evolutionary Life Sciences Rijksuniversiteit Groningen Groningen	Netherlands
KEMP Darrell	School of Natural Sciences Macquarie University Sydney	Australia
KINOSHITA Michiyo	Dept. of Evolutionary Studies of Biosystems The Graduate University for Advanced Studies, SOKENDAI, Kanagawa	Japan

From diffuse to localised signalling: The origin of synaptic neurotransmission in animals

WATANABE Shigeki	Dept. of Cell Biology Johns Hopkins University School of Medicine Baltimore	USA (Japan)
IKMI Aissam	Developmental biology unit EMBL-Heidelberg Heidelberg	Germany (Morocco)
MUSSER Jacob	Dept. of Molecular, Cellular and Developmental Biology Yale University New Haven	USA

Decoding the gelatinous origins of brain evolution

WOLF Fred	Dept. of Physics of Biological Systems University of Göttingen Göttingen	Germany
BURKHARDT Pawel	Sars International Centre University of Bergen Bergen	Norway (Germany)

1.4.2 RESEARCH GRANT – EARLY CAREER

Encoding motion in an interface: The shape-morphing armored skin of pufferfish

AMINI Shahrouz	Dept. of Biomaterials MPI of Colloids and Interfaces Potsdam	Germany (Iran)
CAMP Ariel	Musculoskeletal and Ageing Science University of Liverpool Liverpool	UK (USA)
RAFSANJANI Ahmad	The Maersk Mc Kinney Moller Institute University of Southern Denmark Odense	Denmark (Iran)

Exploration of the structure-function space of prebiotic to biological proteins – RENEWAL APP

FUJISHIMA Kosuke	Earth-Life Science Institute (ELSI) Tokyo Institute of Technology Tokyo	Japan
FREELAND Stephen	Interdisciplinary Studies Program University of Maryland Baltimore	USA (UK)
FRIED Stephen	Dept. of Chemistry Johns Hopkins University Baltimore	USA
HLOUCHOVA Klara	Dept. of Cell Biology Charles University Prague	Czech Republic

Experimentally evolving budding yeast cell size to test scaling laws in cell biology

FUMASONI Marco	Genome Maintenance and Evolution Lab Instituto Gulbenkian de Ciencia Oeiras	Portugal (Italy)
GIOMETTO Andrea	School of Civil and Environmental Engineering Cornell University Ithaca	USA (Italy)

Understanding the neural basis of early language development

MARESCA David	Dept. of Imaging Physics Delft University of Technology Delft	Netherlands (France)
TSUJI Sho	International Research Center for Neurointelligence The University of Tokyo Tokyo	Japan
WEHBE Leila	Dept. of Machine Learning Carnegie Mellon University Pittsburgh	USA (Lebanon)

Uncharted ocean currents: Exploring the electrical behavior of marine phytoplankton

MCCLELLAND Harry	Dept. of Structural and Molecular Biology University College London London	UK
MCCLENAGHAN Conor	Dept. of Pharmacology Rutgers, The State University of New Jersey Piscataway	USA (UK)

Decoding the sulfation codes in the glycocalyx

MILLER Rebecca	Dept. of Cellular and Molecular Medicine University of Copenhagen Copenhagen	Denmark (UK)
ANGGARA Kelvin	Dept. of Nanoscale Science MPI for Solid State Research Stuttgart	Germany (Indonesia)

Switchable immunomodulation of mRNA transport and local translation in microglia by bioactive RNAs

MILOVANOVIC Dragomir	Dept. of Molecular Neuroscience German Center for Neurodegenerative Diseases (DZNE) Berlin	Germany (Serbia)
FU Meng-Meng	National Institute of Neurological Disorders and Stroke NIH NINDS Bethesda	USA
L. J. BROERE Daniël	Dept. of Chemistry Universiteit Utrecht Utrecht	Netherlands
LEPPEK Kathrin	Institute of Clinical Chemistry and Clinical Pharmacology Rheinische Friedrich-Wilhelms-University Bonn Bonn	Germany

Unraveling the multi-layer relationship between archaeal symbionts and their viruses

QUAX Tessa	Dept. of Molecular Microbiology Rijksuniversiteit Groningen Groningen	Netherlands
GHOSAL Debnath	Dept. of Biochemistry & Pharmacology University of Melbourne Melbourne	Australia (India)
GOOD Benjamin	Dept. of Applied Physics The Leland Stanford Junior University Stanford	USA
SAKAI Hiroyuki	Science and Engineering for Sustainable Innovation Soka University Tokyo	Japan

Dark oxygen production: Assessing an overlooked microbial process in Earth's hidden ecosystems

RUFF S. Emil	Ecosystems Center / Bay Paul Center Marine Biological Laboratory Woods Hole	USA (Germany)
HEMINGWAY Jordon	Dept. of Earth Sciences Swiss Federal Institute of Technology Zürich	Switzerland (USA)
KRAFT Beate	Dept. of Biology University of Southern Denmark (SDU) Odense	Denmark (Germany)

1.5

RESEARCH GRANT PROFILE



Photo credit: Lexi Mollica

Jackie GOORDIAL working in the Arctic

Jackie GOORDIAL, Early Career Grant, Canada, with co- investigators James BRADLEY, UK, Chris GREENING, Australia, and Elizabeth TREMBATH-REICHERT, USA

The Atmosphere: A Living, Breathing Ecosystem?

The atmosphere is the largest potential ecosystem on Earth yet the least understood. Life is found across Earth's three major systems, the lithosphere (land), hydrosphere (water), and atmosphere (air). Yet several factors make life poorly understood in the atmosphere: its low microbially dominated biomass, sampling methodological challenges, and low awareness of its importance and complexity

as an ecosystem. Classically, atmospheric-dwelling microbes are thought to be passively dispersed, without performing metabolic activities or mediating ecological interactions. However, recent work suggests that the atmosphere may be a true ecosystem: containing active resident and transient microbes that profoundly influence biology, chemistry, and climate globally. This project will test

whether the atmosphere is indeed 'a living, breathing ecosystem.'

Atmospheric microorganisms influence biodiversity, disease, and potentially climate. Microbes are continually exchanged between land and water through the atmosphere. Their dispersal is one of four key processes controlling community ecology, together with selection, drift, and speciation. In turn, airborne dispersal drives primary succession (ecosystem formation) and influences secondary succession (ecosystem recovery following disturbance), thereby contributing to the maintenance of global biodiversity. Air transports beneficial microbes, invasive taxa, and a range of human, animal, and plant pathogens from local to continental scales. Other ecosystem roles of atmospheric microbes are underexplored, though they are implicated as key ice nucleators responsible for cloud formation and precipitation and are likely sensitive to anthropogenic activities.

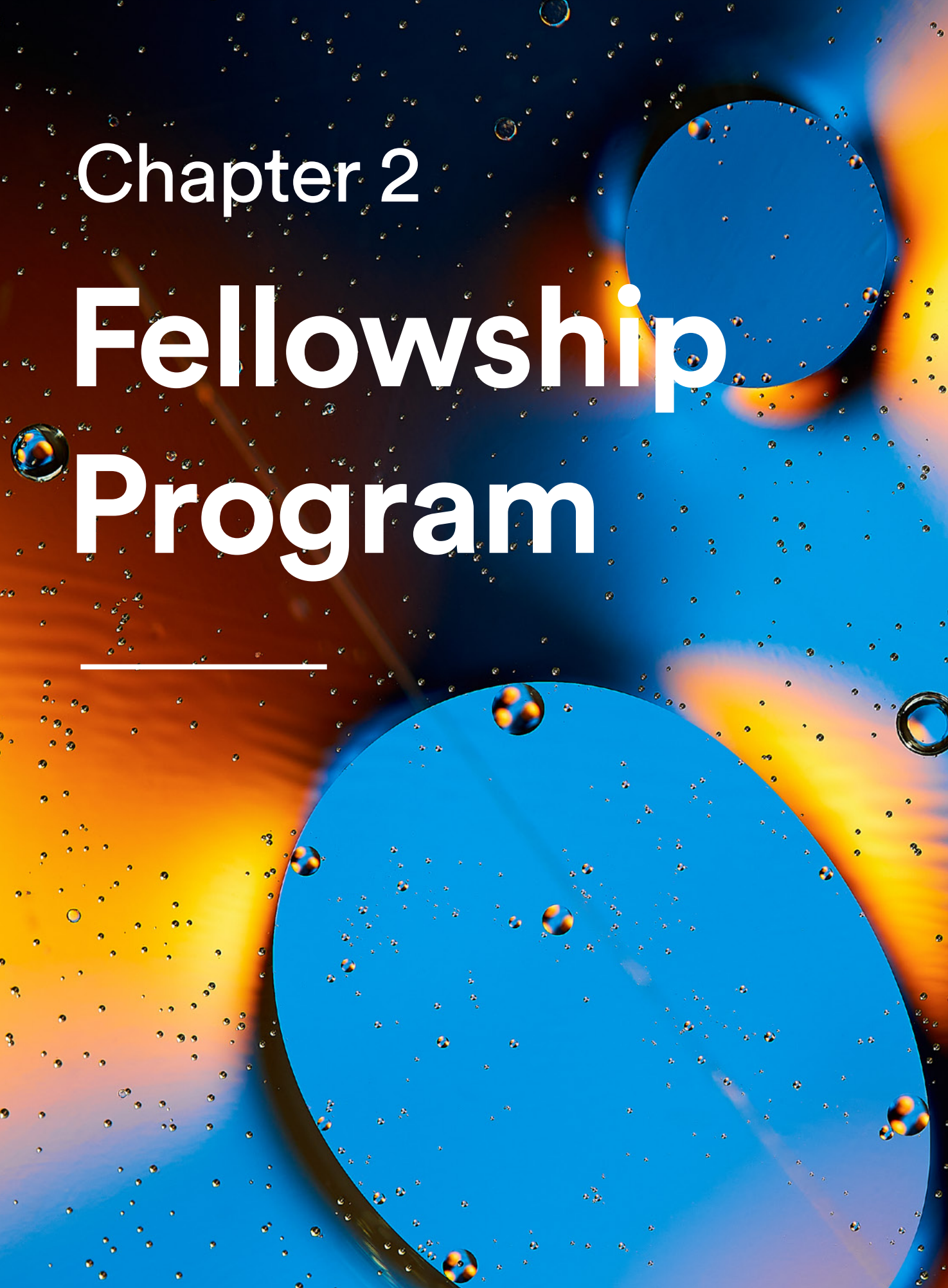
We lack a global picture of the atmospheric microbiome and whether it is comprised of resident or merely transient microbes. In the last decade, studies have attempted to profile atmospheric communities using molecular methods (mostly amplicon sequencing). These studies suggest that diverse microbiota are present in air, at ~ 10⁴ to 10⁵ cells/m³. Atmospheric communities vary across space and time, suggesting some biogeographic structure. However, it is unclear if deterministic (e.g., natural selection for adapted microbes)

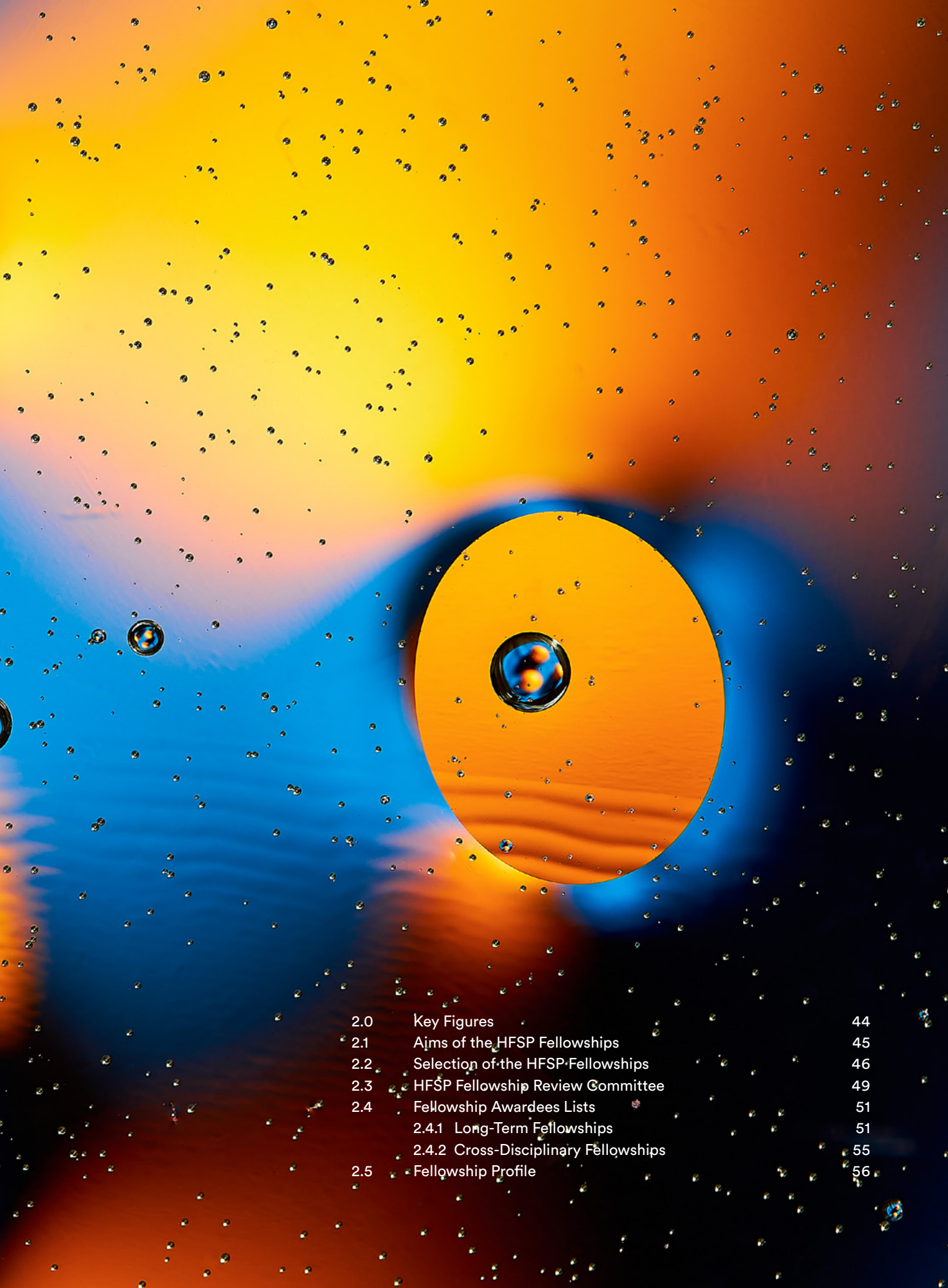
or stochastic processes (e.g., differential dispersal due to spatial proximity and wind conditions) control their assembly. Moreover, the few available studies are confounded by contamination of DNA extracts, including the sole global survey of atmospheric microbiomes in which 1,300 contaminant taxa (comprising 43% of bacterial and 55% of fungal sequences) were present. Such contamination is preventable, and the team has expertise working in extreme, low biomass environments to minimise and account for contamination.



Chapter 2

Fellowship Program





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2.0

KEY FIGURES

- **52 postdoctoral fellowships**, including 46 Long-Term Fellowships and 6 Cross-Disciplinary Fellowships, were awarded in March 2023 from 529 Letters of Intent submitted in May 2022. A total of 429 Letters of Intent were sent out for review. The final success rate based on the 429 reviewed Letters of Intent is 12%.
- 45% of the reviewed applications were from **female applicants**.
- In the competition that ended in March 2023, **11% of the reviewed applications were for the Cross-Disciplinary Fellowship program**.
- As of 28 April 2023, **awardees are of 21 different nationalities** and will carry out their fellowship in 9 different host countries.
- An awardee from Egypt will use her HFSP Long-Term Fellowship at the Hospital for Sick Children in Toronto, Canada, to study the role of altered cortical growth — specifically, the role of outer radial glia cells — in the development of Autism Spectrum Disorder, which affects around 1% of the population worldwide.
- A Korean fellow with a PhD in Physics will use his HFSP Cross-Disciplinary Fellowship at the University of California, Santa Barbara, **to build mechanical protocells by coupling stress-generating active fluids to soft interfaces using dielectric tensor tomography** which he had developed during his PhD training.
- An Indian PhD trained in material sciences will use his HFSP Cross-Disciplinary Fellowship at the Massachusetts Institute of Technology, USA, **to develop genetically encoded reporters for brain-wide studies of neuronal function**.

2.1

AIMS OF THE HFSP FELLOWSHIPS

HFSP offers two types of postdoctoral fellowships:

- **Long-Term Fellowships (LTF)** are for applicants with a PhD in a biological topic who want to embark on a novel frontier project focusing on the life sciences.
- **Cross-Disciplinary Fellowships (CDF)** are for applicants who hold a doctoral degree in a non-biological discipline (e.g., physics, chemistry, mathematics, engineering or computer sciences) and who have not worked in the life sciences before, but want to work on a novel frontier project in biology.

All HFSP fellowships are for three years of research and provide an annual living allowance, as well as a travel allowance. In addition, child, parental leave and relocation allowances are provided where appropriate. All HFSP fellowships must be taken up in a laboratory in a different country to the one where the PhD degree was conferred. Applicants from a country that is not a member of HFSP must hold their fellowship in a HFSP Member country.

HFSP fellowships are flexible. After one year at the host institution, awardees can defer their fellowship for up to two years and can also use the third year in a different country or in their home country. At the end of the fellowship, the awardees can request a six-month, no-cost extension to spend any remaining funds in their host lab. At HFSP we believe that such flexibility is crucial to allow fellows to make the most of their postdoctoral training.

2.2

SELECTION OF HFSP FELLOWSHIPS

The competition for 2023 fellowships was launched in March 2022, employing for the second time a two-step application process consisting of a Letter of Intent, followed by the submission of a full proposal. The largest group of applicants (19%) in the Letter of Intent stage were from non-member countries, illustrating the worldwide reach of HFSP (Figure 2.1 and Table 2.1), followed by candidates from Europe, India, Japan, Italy and France. In total, 529 Letters of Intent were submitted, out of which 429 were eligible and took part in the complete review process. The reviewed applications were from applicants of 55 nationalities proposing to move to 26 host countries.

In March 2023, HFSP announced fellowship awards to scientists of 21 different nationalities. 46 young researchers were awarded Long-Term Fellowships and 6 were awarded Cross-Disciplinary Fellowships.

HFSP fellows chose host labs in 9 countries, with 50% of fellows going to labs in the United States of America (Figure 2.2). Since 1990, HFSP fellows have been hosted in 23 countries.

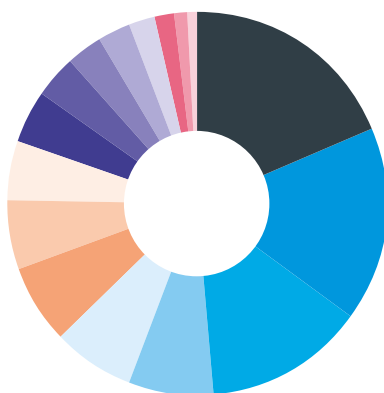


Figure 2.1
Number of Fellowship Applicants by Nationality

80	Non-members*	19	Korea
71	Europe**	16	Israel
58	India	13	Germany
31	Japan	11	Australia
30	Italy	10	Canada
29	Dual nationalities	7	UK
24	France	5	Singapore
22	USA	3	New Zealand

* 80 applicants were from countries that are not members of the Organization.

** 71 applicants were from countries of the European Union that are not individual members of HFSP but are represented by the membership of the European Commission.

Table 2.1**Nationalities of Long-Term (LTF) and Cross-Disciplinary (CDF) Fellowship Applicants and Awardees Awarded as 28 April 2023**

Nationality	LTF applicants	LTF awardees	CDF applicants	CDF awardees	Total awardees
Australia	11	0	0	0	0
Canada	9	1	1	0	1
Europe	66	5	5	0	5 ⁽¹⁾ *
France	22	1	2	0	1
Germany	13	2	0	0	2*
India	44	5	14	1	6
Israel	15	4	1	0	4*
Italy	26	4	4	1	5*
Japan	31	3	0	0	3
Korea	16	2	3	2	4
New Zealand	3	0	0	0	0
Norway	0	0	0	0	0
Singapore	5	1	0	0	1
South Africa	0	0	0	0	0
Switzerland	0	0	0	0	0
UK	6	0	1	0	0
USA	19	6	3	0	6*
Non-members⁽⁴⁾	68	8	12	1	9 ⁽²⁾
Dual nationalities	26	4	3	1	5 ⁽³⁾
TOTAL	380	46	49	6	52

* Additional awardees holding dual nationalities are accounted for in the “Dual nationalities” row (for details see point (3) below).

(1) The five European Long-Term Fellowship awardees come from Greece, The Netherlands, Portugal, Spain and Sweden.

(2) The nine awardees from non-member countries come from Chile, China (4), Egypt, Mexico, Taiwan and Thailand.

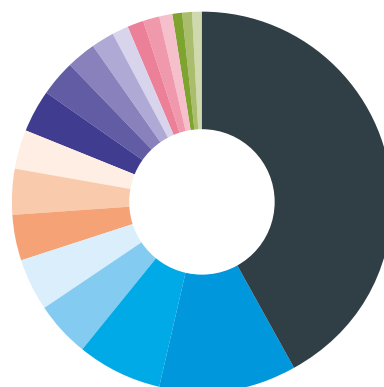
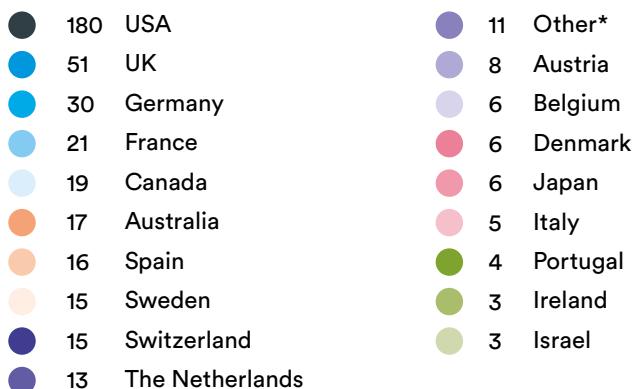
(3) Among the five successful applicants who hold dual nationalities, three are from HFSP member countries: Israel/USA, Israel/Germany (2). The other two are from Italy/Argentina and Croatia/Bosnia and Herzegovina.

(4) The applicants from non-member countries come from Argentina, Bangladesh, Brazil, Cameroon, Chile, China, Colombia, Cuba, Egypt, Ethiopia, Indonesia, Iran, Liechtenstein, Malaysia, Mexico, Mongolia, Nigeria, Peru, Russia, Serbia, Syria, Taiwan, Thailand, Turkey and Vietnam.

Figure 2.2

Host Country of Long-Term and Cross-Disciplinary Fellowship Applicants and Awardees as of 28 April 2023

Host Country of Applicants for the 2023 Cycle



* There were 11 applications for the following additional host countries: Colombia 2, Norway 2, Singapore 2, Czech Republic 1, Finland 1, Luxembourg 1, New Zealand 1, South Africa 1

Host Country of Awardees for the 2023 Cycle -- as of 28 April 2023

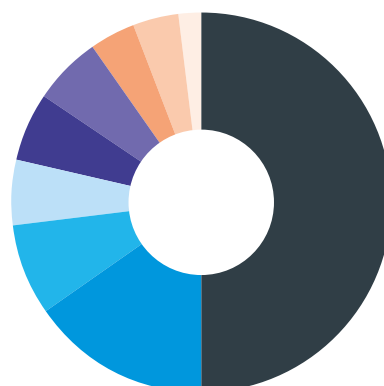


Table 2.2

Gender of Long-Term (LTF) and Cross-Disciplinary (CDF) Fellowship Applicants and Awardees as of 28 April 2023

	Applications		Awards	
	LTF	CDF	LTF	CDF
Number of female scientists	175	17	15	2
	46.1%	34.7%	32.6%	33.3%
Number of male scientists	200	32	31	4
	52.6%	65.3%	67.4%	66.7%
Total number of scientists*	375	49	46	6

*Gender not provided by five Long-Term Fellowship applicants

2.3

HFSP FELLOWSHIP REVIEW COMMITTEE

NON-REVIEWING CHAIR

- Jonathan WHITLOCK, Norwegian University of Science and Technology, Trondheim, Norway

AUSTRALIA

- Jacqueline MATTHEWS, University of Sydney, Sydney

CANADA

- Daniel SCHRAMEK, Mount Sinai Hospital, Toronto

EUROPEAN UNION

- Megan CAREY, Champalimaud Centre for the Unknown, Lisbon, Portugal

FRANCE

- Ana CUMANO, Pasteur Institute, Paris
- Stéphanie DESCROIX, Institut Curie, Paris
- François FAGOTTO, University of Montpellier, Montpellier

GERMANY

- Victor SOURJIK, Max Planck Institute for Terrestrial Microbiology, Marburg

INDIA

- Vatsala THIRUMALAI, National Centre for Biological Sciences, Bangalore

ISRAEL

- Naama BARKAI, Weizmann Institute of Science, Rehovot
- Michael KOZLOV, Tel Aviv University, Tel Aviv

ITALY

- Raffaele DE FRANCESCO, Istituto Nazionale Genetica Molecolare, Milan

JAPAN

- Gohta GOSHIMA, Nagoya University, Nagoya
- Takashi TSUCHIMATSU, University of Tokyo, Tokyo



Johnathan WHITLOCK

Chair of the HFSP
Fellowship Review Committee

NEW ZEALAND

- Peter FINERAN, University of Otago, Dunedin

NORWAY

- Jonathan WHITLOCK, Norwegian University of Science and Technology, Trondheim

REPUBLIC OF KOREA

- Daehee HWANG, Seoul National University, Seoul
- Sungjune JUNG, POSTECH, Pohang

SINGAPORE

- Hao YU, National University of Singapore, Singapore

SWITZERLAND

- Nicola ZAMBONI, ETH Zürich

UNITED KINGDOM

- Robert INSALL, University of Glasgow, Glasgow
- Evangelia PETSALAKI, Wellcome Genome Campus, Hinxton
- Scott WADDELL, University of Oxford, Oxford

UNITED STATES OF AMERICA

- Mary Kay LOBO, University of Maryland School of Medicine, Baltimore
- Christine RICHARDSON, University of North Carolina, Charlotte

DELEGATE FROM THE COUNCIL OF SCIENTISTS

The HFSP Council of Scientists is responsible for overseeing the peer review process of HFSP funding programs. Each year a Council member participates in the Review Committee meetings as an observer with the role to monitor due diligence of the proceedings.

- Juliet DANIEL, McMaster University, Hamilton, Canada

2.4

FELLOWSHIP AWARDEES LISTS

Fellowship awards as of 28 April 2023
(to be initiated during FY 2023)

Nationality of awardees in brackets, followed by the location of the host research laboratory.

2.4.1 LONG-TERM FELLOWSHIPS

- **Deciphering the role of outer radial glia in autism**
AHMED Mai (Egypt)
The Hospital for Sick Children, Toronto, Canada
- **Profiling tumor proteolysis with genetically-encoded signaling integrators**
ALGOV Itay (Israel)
Dana-Farber Cancer Institute, Boston, USA
- **Investigating the cell-matrix mechano-chemical feedback loops as determinants of tissue fate**
ALLANKI Srinivas (India)
The Francis Crick Institute, London, UK
- **Transcriptional adaptation during vertebrate development at the single-cell level**
BELLEC Maelle (France)
Max Planck Institute for Heart and Lung Research, Bad Nauheim, Germany
- **Viral cooperation as a novel mechanism to overcome bacterial defenses**
BOBONIS Jacob (Greece)
University of Vienna, Austria
- **Gating mechanism of insect auditory transduction channels**
CHAIYASITDHI Atitheb (Thailand)
University of Leicester, UK
- **Functional exploration and machine learning of the solute binding domain transcription factors**
CHEN John (Canada)
The Australian National University, Canberra, Australia
- **Structure of the synaptic vesicle**
DAS Poulomi (India)
University of California, San Francisco, USA

- **Investigation of uropathogenic E. coli virulence mechanisms in a human bladder microtissue model**
DE BENTO FLORES Carlos Eduardo (Portugal)
Biozentrum, University of Basel, Switzerland
- **Unraveling limb size determinants using mouse-jerboa chimera**
GOEL Isha (India)
Monash University, Clayton, Australia
- **Utilizing spatial transcriptomics for uncovering the hypoxic transcriptional landscape of tumors**
GUSTAFSSON Johan (Sweden)
Broad Institute of MIT and Harvard, Cambridge, USA
- **Investigating the mechanistic role of the gut microbiome in modulating depressive behavior in mice**
GUZZETTA Katherine (USA)
ETH Zürich, Switzerland
- **Investigating the cross talk between glioma cells and oligodendrocytes in brain tumors**
HAN Jichang (China)
Miller School of Medicine of the University of Miami, Coral Gables, USA
- **Disentangling microbiome effects on plant adaptation**
HERNANDEZ-TERAN Alejandra (Mexico)
University of California, Irvine, USA
- **Growth and folding of a wing origami**
HIROKAWA Soichi (USA)
Developmental Biology Institute of Marseille, France
- **Rock-paper-scissors dynamics between mobile genetic elements**
HUISMAN Jana Sanne (The Netherlands)
Massachusetts Institute of Technology, Cambridge, USA
- **Mapping the spatiotemporal organization and mechanosensitivity of gamma delta T cell synapses**
JUKIC Nebojsa (Croatia/Bosnia and Herzegovina)
Institute for Atomic and Molecular Physics, Amsterdam, The Netherlands
- **A role for enteric neuroimmune interactions in the development of obesity**
KIM Dong-Yoon (Republic of Korea)
The Rockefeller University, New York, USA
- **Brain remodeling mediated by molecular memory of the social conflict in the ant *Harpegnathos***
LEE Ching-Han (Taiwan)
New York University, USA
- **Exploring immune-pancreatic progenitor crosstalk during pancreatic development**
LEE Christopher (Singapore)
King's College London, UK
- **Investigation of astrocytic surface molecule-mediated T cell regulation in health and disease**
LEE Joon-Hyuk (Republic of Korea)
Brigham and Women's Hospital, Boston, USA

- **Understanding the role of mitochondrial redox sensing in cancer**
 LIU Shanshan (China)
The Rockefeller University, New York, USA
- **During growth of sensory systems, how do sensorimotor loops adjust their gain?**
 LUNSFORD Elias (USA)
Paris Brain Institute, France
- **Artificial morphogenesis: creating a synthetic segmentation clock**
 MANELLA Gal (Israel/Germany)
California Institute of Technology, Pasadena, USA
- **In-depth analysis of sporeling development as a model to study shoot meristem formation in plants**
 MEIR Zohar (Israel/Germany)
Gregor Mendel Institute of Molecular Plant Biology, Vienna, Austria
- **A polymicrobial adaptive evolution framework to investigate co-evolution to stress**
 MOZZACHIODI Simone (Italy)
University of Cambridge, UK
- **Dissecting the combinatorial function of transcription factors during zygotic genome activation**
 MUTZEL Verena (Germany)
CNRS, Montpellier, France
- **Activation and cargo interaction of molecular motors**
 NAAZ Farha (India)
University of Warwick, Coventry, UK
- **Uncovering the molecular mechanisms behind chromatin modification-directed mutation bias**
 OYA Satoyo (Japan)
University of California, Davis, Davis, USA
- **Hijacking mosquitoes: how arboviruses manipulate vector behaviour**
 PALATINI Umberto (Italy)
The Rockefeller University, New York, USA
- **The regulatory and developmental basis of cranial lateral line evolution in cichlid fishes**
 PALOMINOS Fernanda (Chile)
University of Cambridge, UK
- **Coevolution of body morphology, neural circuits and behavior**
 PHELPS Jasper (USA)
École Polytechnique Fédérale de Lausanne, Switzerland
- **Ant aggregation pheromones: from social behavior to neural coding**
 ROSSI Matteo (Italy)
The Rockefeller University, New York, USA
- **Membrane factors ensuring robustness of photosynthesis on a warming planet**
 SACCON Francesco (Italy)
Wageningen University, The Netherlands

- **Studying the role of synaptic connectivity in learning and memory via new voltage imaging techniques**
 SHEINTUCH Liron (Israel)
University of California, Los Angeles, USA
- **Functional proteomics to dissect spatiotemporal dynamics of viral RNA bound macromolecular complexes**
 SINHA Ameya (India)
Helmholtz-Zentrum für Infektionsforschung, Braunschweig, Germany
- **Epigenetics of aging-associated behavioral changes and loss of brain plasticity using the ant model**
 SOREK Matan (Israel)
University of Pennsylvania, Philadelphia, USA
- **Molecular and morphogenetic characterization of early neurogenesis in cephalopods**
 STOCK Jessica (Germany)
Marine Biological Laboratory, Woods Hole, USA
- **Behavioral functions and microcircuit mechanisms of heading representation in larval zebrafish**
 TANAKA Ryosuke (Japan)
Technical University of Munich, Germany
- **Semantic-motor representation and plasticity for M1**
 TSAY Jonathan (USA)
MRC Cognition and Brain Sciences Unit, Cambridge, UK
- **Understanding tumor-immune interactions in cancer initiation and progression**
 VEGA-PÉREZ Adrian (Spain)
Weill Medical College of Cornell University, New York, USA
- **Mapping the functional connectome for conscious perception**
 WESTERBERG Jacob (USA)
Netherlands Institute for Neuroscience-KNAW, Amsterdam, The Netherlands
- **Phytoplankton translational regulation: from models to communities**
 WIENER David (Israel/USA)
University of Washington, Seattle, USA
- **Discovery of new cyclic nucleotide immune receptors in human innate immunity**
 YAMAGUCHI Sonomi (Japan)
Dana-Farber Cancer Institute, Boston, USA
- **Mechanistic investigations of the circuits driving spontaneous neuropathic pain**
 ZENG Xiangsunze (China)
Boston Children's Hospital, Boston, USA
- **Dynamic spatiotemporal monitoring of cell state transitions**
 ZILBERZWIGE-TAL Shai (Israel)
Massachusetts Institute of Technology, Cambridge, USA

2.4.2 CROSS-DISCIPLINARY FELLOWSHIPS

- **Highly parallel determination of protein identity and function with single-molecule resolution**
CHOI Hansol (Republic of Korea)
Boston Children's Hospital, USA
- **Statistical physics modelling of large-scale brain activity**
MIGNACCO Francesca (Italy)
Princeton University, USA
- **In vitro control of cell extrusion through curved surfaces**
SHEN Yuan (China)
CNRS, Villejuif, France
- **Building mechanical protocells by coupling stress generating active fluids to soft interfaces**
SHIN Seungwoo (Republic of Korea)
University of California, Santa Barbara, Santa Barbara, USA
- **Genetically encoded reporters for brain-wide studies of neuronal function**
TIRUKOTI Deva Nishanth (India)
Massachusetts Institute of Technology, Cambridge, USA
- **Mechanotransduction of T cell antigen recognition examined with 3D super-resolution imaging**
ZAZA Cecilia (Italy/Argentina)
University College London, UK

2.5

FELLOWSHIP PROFILE

2019 Long-Term Fellowship

Exploring the human fetal microbiome and its role in immune system development



Archita MISHRA

Fellowship in Singapore

Archita MISHRA

Host supervisor: **Florent GINHOUX**, A*STAR, Singapore

Fetal development in the womb is an intricate process that defines overall growth and health of an individual. Key factors transferred from the mother to the fetus during this process establish the cornerstones of early life immunity and life-long tolerance. Recent studies have shown that by 12-16 weeks of gestation, the fetus starts to develop a functional immune response.

Long-Term Fellowship awardee Archita Mishra demonstrates for the first time that human fetal organs have bacteria that may provide immunity against environmental exposure upon birth. Dr. Mishra and her host supervisor Florent Ginhoux (A*STAR, Singapore) found that fetal T cells exhibit an activated memory response towards microbial antigens encountered in utero. Further studies are now required to explore the antigenic specificities of these T cell-microbial interactions in human fetal organs and the synergy with a non-antigen specific (cytokine-mediated) response. This research bears important translational implications in devising better therapeutic interventions for newborn babies.

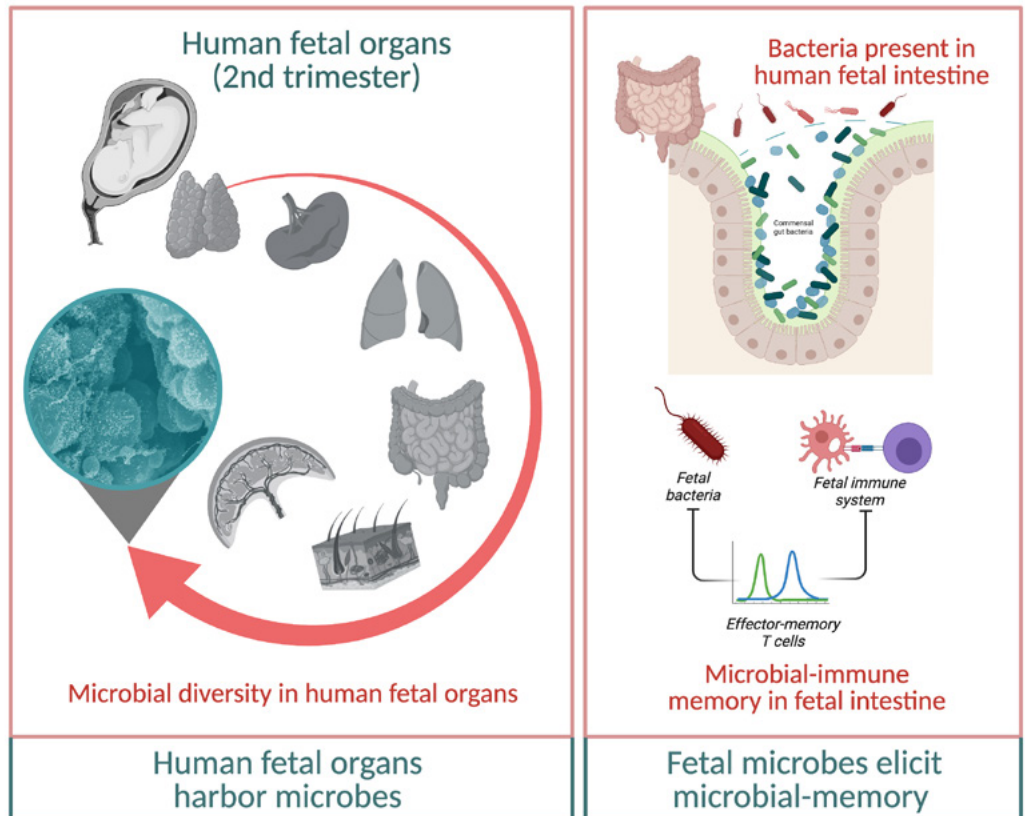


Figure legend: Human fetal tissues and placenta in second trimester of gestation harbour live bacterial strains that are more abundant and diverse in fetal skin, gut and placenta. These microbes can induce the activation of effector memory T-cells in the fetal gut, thereby providing the evidence of microbial-immune memory during fetal development.

Mishra A. et al, (2021).

Microbial exposure during early human development primes fetal immune cells. *Cell*, 184, 1-16

Chapter 3

HFSP's Scientists for Scientists Initiative



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3.0

HFSP SUPPORT FOR UKRAINIAN SCIENTISTS

In 2022, HFSP launched the Scientists for Scientists Initiative (S4S) to help Ukrainian researchers affected by the war to continue their research in HFSP-affiliated host institutions around the world. The initiative was possible due to generous additional funding support from the European Commission.

The idea of the initiative is to bring help to scientists in the quickest and least bureaucratic manner possible. The S4S call is open to all HFSP Awardees in currently active projects, offering supplemental funds for the meaningful (=scientifically well-grounded and argued for) integration of Ukrainian scientists, whom HFSP Awardees identify and invite, into the HFSP-supported, ongoing research efforts. Both HFSP Research Grant teams, as well as HFSP Fellows are eligible for the additional funding, and both schemes did benefit from this specific, targeted call.

Overall, 14 projects were selected so far for support and the Ukrainian researchers have been integrated

into teams of an average size of 3 Principal Investigator (PI) -researchers. In total, some 41 PI-researchers, and close to 80 other scientists across almost 50 countries work in these HFSP supported projects that are hosting the scientists from Ukraine. The exposure to truly interdisciplinary, international research will be an invaluable experience for the Ukrainian scientists which will help them lead this type of frontier research themselves in the future. HFSP awardees are an active and very international community, and it is valuable for Ukrainian S4S scientists to be part of this global scientific network. It will benefit them directly as individuals, but it will also generate indirect benefit to their peers in their home country by expanding the reach of their professional networks.

The integration of researchers into ongoing projects allowed to expedite the review of the applications, as the scientific merit of the research project had already been well proven and documented through the HFSP Peer Review

process. It was therefore possible to judge the fit and synergy of the additional researcher quickly. Funding decisions could therefore be taken within days, and the funding made available in a few weeks in most cases. This has proven to be a major asset for affected Ukrainian scientists, especially during first months after the war started.

To support the further networking between the projects, and to increase the overall exposure of S4S initiative, and scientists involved, Ukrainian guest scientists and their hosts have been invited to the 2022 HFSP Awardees Meeting in Paris. More details on the funded projects and researchers are given in Table 3.1 below.

Table 3.1**HFSP Research Projects Supported During the Fiscal Year through the Scientists for Scientists Initiative**

N°	Research Title	Ukrainian Scientist	HFSP Host	Host Institution
1	Unravelling an unusual biomineralization from nano to macro scale using advanced technologies	Anastasiia Maliuk	Mehran Moazen	University College London, UK
2	Controlling cellular biochemistry with electronic signals – a step towards bioelectronic hybrids	Oleh Smutok	Evgeny Katz	Clarkson University, NY, USA
3	Mechanosensitive dynamics at the fertilisation synapse	Tetiana Mylenko	Andrea Pauli	Research Institute of Molecular Pathology, Vienna, Austria
4	A new role for aging: origin of cellular differentiation and the evolution of complex life	Uliana Semaniuk	Juha Saarikangas	Helsinki Institute of Life Science HiLIFE, Molecular and Integrative Biosciences Research Program, Finland
5	Regulation of membrane receptor function in the brain by lipid composition and dietary inputs	Daryna Sputay	Ilya Levental	University of Texas Health Science Center at Houston, USA
6	Investigating mechanotransduction at a single molecule level	Viktoriia Kashchuk	Anatolii Kashchuk	University of Florence, Italy
7	Investigating collinear bursts of HoxD genes transcription through live imaging of gastruloid body	Yuliia Romaniuk	Alexandre Mayran	EPFL-Lausanne, Switzerland
8	Pex ex machina: the cell biological mechanics of locally-controlled peroxisome biogenesis	Anya Borisyuk	Triana Amen	EPFL-Lausanne, Switzerland
9	How transcriptional and epigenetic networks shape lung-resident memory T cells and tissue immunity	Nataliia Liakhovska	Alexander Lercher	Rockefeller University, NY, USA
10	Tracking trade across symbiotic networks	Oleh Prylutskyi	Toby Kiers	VU University Amsterdam, The Netherlands
11	Bacterial biofilms as a multicellular organism: from molecules to populations	Iryna Peretiazhko	Julien Bergeron	King's College London, UK
12	A spatiotemporal map of signalling processes controlling human stem cell renewal and differentiation	Karyna Kulakova	Rafael E. Carazo Salas	University of Bristol, UK
13	Evolution of neural circuit dynamics and brain computations in <i>Astyanax</i> blind cave fish	Solomiya Lebid	German Sumbre	Institut de Biologie de l'École Normale Supérieure, France
14	Can evolution minimize spurious signaling crosstalk to reach optimal performance?	Mariia Utrobina	Christian Landry	Université Laval, Canada

3.1

SCIENTISTS FOR SCIENTISTS PROFILE

A New Role for Aging:
Origin of Cellular
Differentiation and the
Evolution of Complex
Life.



Juha SAARIKANGAS
and **Uliana SEMANIUK**

Host:

Juha SAARIKANGAS, 2020
HFSP Research Grant Awardee
Institute of Life Science
HiLIFE – Helsinki, Finland

Grant Team: Juha
SAARIKANGAS, Finland;
William RATCLIFF, USA

Visiting Ukrainian Scientist:

Uliana SEMANIUK, Dept. of
Biochemistry and Biotechnology,
Vasyl Stefanyk Precarpathian
National University,
Ivano-Frankivsk, Ukraine

Uliana Semaniuk is a biochemist specializing in the biology of aging, who joined our HFSPo-funded project, **A New Role for Aging: Origin of Cellular Differentiation and the Evolution of Complex Life.**

In her PhD project, which she started in 2013, Uliana characterized the impact of nutrition on *Drosophila melanogaster* aging, focusing specifically on the role of aging. She has published 15 peer-reviewed papers and is the primary author on five of them.

The ongoing war in Ukraine prevented the progression of her scientific work in her native country, effectively putting her career on hold until she joined the S4S Initiative. Uliana's background in aging biology and metabolism are a great match with our HFSPo project, where my team, together with Will Ratcliff's group, are studying the origins of

cellular differentiation. We use a multicellular budding yeast model that has been experimentally evolved in the Ratcliff laboratory by selecting for large size. Over thousands of generations, this experiment has resulted in multicellular groups that are more than 20,000 times larger and 10,000 times more mechanically tough than their ancestors. This system enables us to study how multicellular adaptations arise and address whether cellular aging has a role in the origin of spatial developmental patterns.

"The Scientists for Scientists Initiative is a wonderful response from HFSPo to help Ukrainian scientists and their families, who are affected by the war. We feel fortunate to be able to welcome Uliana Semaniuk to integrate her scientific expertise into this exciting frontier research project." -- Juha SAARIKANGAS, Assoc. Prof., University of Helsinki, Finland

"In January of 2022, my goal was to defend my PhD thesis, and I did not have plans to work abroad. But the war in Ukraine adjusted that. I am very grateful to HFSPo for this opportunity. Thanks to the Scientists for Scientists Initiative, I had the strength the whole time I was in Ukraine to move forward step by step toward my PhD defense. HFSPo also ensured a peaceful life for my son, for which I am incredibly grateful. As for the work, I am very excited since this project represents a completely new perspective for me to study the role of aging in evolution." -- Uliana SEMANIUK, Vasyl Stefanyk Precarpathian National University

Chapter 4

HFSP

Science,

Impact &

Engagement



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4.0

BREAKTHROUGH RESEARCH AND IMPACT

Often, HFSP-supported research leads to lasting impact by providing technological innovation and advanced insights into complex mechanisms. Highlights from HFSP awardees can be found in the science articles posted on the HFSP website about breakthrough discoveries and novel approaches. Three are selected below.

Using synthetic biology to create next generation biosensors

Supported by their 2018 HFSP Research Program Grant, Kirill Alexandrov and Evgeny Katz combine electronic and natural systems into bioelectronic hybrids. HFSP funding enabled a multidisciplinary team to develop a range of bioelectronic sensors, most recently for methotrexate, a toxic chemotherapy drug requiring precise monitoring to avoid life-threatening side effects in cancer patients.

Their work on bioelectronic hybrids aims to transform a USD \$70 billion global diagnostic industry via

new synthetic biology enabled biosensors that ‘switch on’ colour or electrical responses to drugs used in cancer, arthritis, and organ transplant treatments. This work is based on a modular approach to constructing small molecule biosensors – artificial proteins designed to capture biomarkers of choice and produce specific and sensitive responses. The research was carried out at the CSIRO-QUT Synthetic Biology Alliance (Australia), in collaboration with Clarkson University (USA) and Pathology Queensland (Australia) and primary funding was provided by the HFSP.

Over multiple collaborative projects, biosensors were developed and adapted to accurately measure protein biomarkers of stress such as α -amylase. Also a range of small molecule biosensors was developed, including those for the immunosuppressant drugs cyclosporine A,

tacrolimus and rapamycin, along with the anticancer drug methotrexate, which requires close monitoring to reduce toxicity and organ damage. Such protein biosensors have the potential to expand patient care by enabling sophisticated tests on cheaper lab equipment and new portable point-of-care devices, allowing therapeutic drug monitoring on less sophisticated equipment than available in small, regional or remote labs and hospitals. Future tests may also require smaller biological samples, the team having proved that a biosensor could accurately measure cyclosporine A levels in one microlitre blood samples.

Protein complexity and fragility makes construction and use of such protein biosensors difficult, but using a modular architecture helps alleviate the problem and could be adapted to potentially target any small molecule and not just to therapeutic drugs. The Clarkson team has also demonstrated the feasibility of advancing this technology to detect two different biomarkers at the same time.

The success of this project was based on the collaboration of scientists with expertise in different areas: synthetic biology, synthetic organic chemistry, and bioelectrochemistry. It is an exemplary collaboration that serves as a model for performing multi-disciplinary research. While the artificial enzyme preparation was carried out by an Australian team led by Prof. Alexandrov, the bioelectrochemical study of the developed biosensor was performed by Dr. Smutok at Clarkson University. Both the US and Australian teams are continuing their successful work combining synthetic biology and bioelectronics and are expecting many more interesting and practically important results. The critical and continuous contributions of Dr. Artem Melman at Clarkson University, who passed away in November 2021, is gratefully acknowledged.



Susana CLUSELLA-TRULLAS

Water or land: are the middle ears of aquatic birds designed to hear in both?

HFSP Research Grant – Early Career Grant holder Susana Clusella-Trullas and colleagues are interested in how sound transmits to birds living in diverse environments. Sound originating on land can be heard underwater, but the intensity is much lower as sound waves are reflected at the water's surface. The concept of resistance or impedance of different media is key to understanding how sound waves reach the inner ear of animals. In air, the middle ear of vertebrates amplifies pressure as sound travels from air to the fluid of the inner ear. In water, the middle ear needs to amplify the vibration velocity of sound, rather than pressure, as the impedance of the inner ear is typically slightly lower than that of the surrounding water. The scientific team found that amphibious vertebrates exhibit adaptations to the middle ear that permit underwater hearing, but which may limit their hearing in air.

Birds represent a great group to test these ideas because they span a tremendous diversity of lifestyles, live in a wide array of environments, and exhibit different degrees of amphibious activity.

Furthermore, land-water transitions have occurred several times in distinct groups, and several lineages include both aquatic and terrestrial species, or species with different degrees of aquatic exposure (shallow foragers versus underwater-pursuit foragers).

For highly aquatic birds, hearing underwater may be as important as hearing on land. Yet, specializations that permit them to hear underwater and protect their ears from barometric pressure could constrain aerial hearing. We found several non-related groups of aquatic birds with similar structural adaptations that increase hearing sensitivity in water, which supports the idea these morphological changes were functional. There is increasing evidence that some aquatic birds use sound as a reliable sensory signal for detecting prey or communicating with members of the same species. Ducks, cormorants, and penguins, indeed several species, respond to sound cues underwater. In fact, a recent study showed that the hearing sensitivity of a cormorant species in water was higher than in air, revealing specializations of the middle ear to underwater hearing that are similar to turtles and aquatic frogs.

To better understand which morphological changes might make the most difference to birds living different lifestyles, scientists scanned the heads of naturally deceased birds from 127 species, representing 26 taxonomic orders, and measured specific ear structures. They predicted that the ear anatomy of aquatic birds might involve, a smaller ratio between the eardrum and the footplate of the columella (the principal ossicle of the ear of birds) that would reduce the increase in pressure expected from aerial hearing. Likewise, a more centrally placed columella tip and more flattened tympanic membrane could increase vibration velocity in water. While some structural changes may affect sound transmission, other modifications may have evolved to protect the ear from barometric pressure during diving. Stiffer and thicker eardrums can protect against increasing water pressure; but greater stiffness might also compromise hearing sensitivity in air. They found several modifications of the middle ear among aquatic birds and found these adaptations recurred across multiple independent bird lineages.



Jae Kyoung KIM

How our circadian rhythm can be both strong and flexible

HFSP Research Grant - Early Career holder Jae Kyoung Kim and colleagues used a combination of mathematical modeling and experiments to identify the difference in molecular clockworks of the master and slave clock neurons in *Drosophila*. Their work is based on the discovery of the molecular mechanism of the circadian clock, which was recognised by the Nobel Prize in Physiology or Medicine in 2017. From what is known, it is not a single centralized clock that is responsible for our circadian cycles. Instead, it operates in a hierarchical network with a “master pacemaker” and a “slave oscillator.” The master pacemaker receives various input signals from the environment such as light. It then drives the slave oscillator that regulates various outputs such as sleep, feeding, and metabolism. Despite the different roles of the pacemaker neurons, they are known to share common molecular mechanisms that are well conserved in all lifeforms. For example, interlocked systems of multiple transcriptional-translational feedback loops (TTFLs) composed of core clock proteins have been extensively studied in fruit flies.

However, there is still much that we need to learn about our own biological clock. The hierarchically organized nature of master and slave clock neurons leads to a prevailing belief that they share an identical molecular clockwork. At the same time, the different roles they serve in regulating bodily rhythms also raise the question of whether they might function under different molecular clockworks.

The team of researchers used a combination of mathematical and experimental approaches using fruit flies to answer this question and they found that the master clock and the slave clock operate via different molecular mechanisms. In both master and slave neurons of fruit flies, a circadian rhythm-related protein called PER is produced and degraded at different rates depending on the time of the day. Previously, the team found that the master clock neuron (sLN_vs) and the slave clock neuron (DN1_{ps}) have different profiles of PER in wild-type and *Clk-Δ* mutant *Drosophila*. This hinted that there might be a potential difference in molecular clockworks between the master and slave clock neurons.

However, due to the complexity of the molecular clockwork, it was challenging to identify the source of such differences. Thus, the team developed a mathematical model describing the molecular clockworks of the master and slave clocks. Then, all possible molecular differences between the master and slave clock neurons were systematically investigated by using computer simulations. The model predicted that PER is more efficiently produced and then rapidly degraded in the master clock compared to the slave clock neurons. This prediction was then confirmed by follow-up experiments using animals.

Then, why do the master clock neurons have such different molecular properties from the slave clock neurons? To answer this question, the research team once again used the combination of mathematical model

simulation and experiments. It was found that the faster rate of synthesis of PER in the master clock neurons allows them to generate synchronized rhythms with a high level of amplitude. Generation of such a strong rhythm with high amplitude is critical to delivering clear signals to slave clock neurons.

However, such strong rhythms would typically be unfavorable when it comes to adapting to environmental changes. These include natural causes such as different daylight hours across summer and winter seasons, up to more extreme artificial cases such as jet lag that occurs after international travel. Thanks to the distinct property of the master clock neurons, it is able to undergo phase dispersion when the standard light-dark cycle is disrupted, drastically reducing the level of PER. The master clock neurons can then easily adapt to the new diurnal cycle. Our master pacemaker's plasticity explains how we can quickly adjust to the new time zones after international flights after just a brief period of jet lag.

It is hoped that the findings of this study can have future clinical implications when it comes to treating various disorders that affect our circadian rhythm. Jae Kyoung Kim notes, "When the circadian clock loses its robustness and flexibility, the circadian rhythms sleep disorders can occur. This study identifies the molecular mechanism that generates robustness and flexibility of the circadian clock. Insight from this work will facilitate identifying the causes of, and treatments for, circadian rhythm sleep disorders.

4.1

SECRETARY-GENERAL'S MISSIONS IN FY 2022

HFSP0 Secretary-General Pavel Kabat traveled widely to meet with HFSP0 Member country trustees, government leaders in key science agencies, and research funding organizations. He visited laboratories, spoke with scientists and program officials, and learned how each Member country has specific strengths and needs, and what each brings to HFSP0. For each country, an in-depth country profile detailing the Member country's history and successes within HFSP0 was prepared. Kabat sought the advice of trustees regarding the HFSP0 Strategic Plan for 2024-2032, which is under development. He also connected with government officials in countries that are potentially interested in joining HFSP0. Throughout, the goal was to deepen ties with those who have a keen stake in the vitality of HFSP0, renew their commitment, and ensure a two-way flow of creative ideas and common vision for a strong future in frontier life science research. Below are some highlights from a few key visits; a more complete overview with the official visits is presented in Table 4.1, on page 74.

27 MAY – 2 JUNE 2022 - GLOBAL RESEARCH COUNCIL (GRC), PANAMA

The 10th GRC Annual Meeting, was jointly hosted by the National Secretariat of Science, Technology and Innovation (SENACYT) and the U.S. National Science Foundation (NSF). In total, 140 delegates from 40 countries, including 45 Heads of Research Councils participated to share best practices and discuss common research funding policy priorities and issues.

Kabat was invited to make a presentation of HFSP0's research programs and leadership role in the global frontier life science enterprise. As the GRC is a major player in the world of international research and many of HFSP0's Members are also Members of the GRC, high-level participation is important to our global visibility. Over several days of sessions, Kabat opened opportunities to speak with the national representatives of potential new Member countries, and in fact, succeeded in encouraging South Africa to become a HFSP0 Member country in 2023.

5 – 6 SEPTEMBER 2022 - OSLO, NORWAY

Over two days, Kabat visited scientists, academic leaders, and also government officials at the Norwegian Academy of Science and Letters, and Mari Sundli Tveit, CEO of the Research Council of Norway. He spoke at length with some of the scientists who have been investigators of HFSP-supported research grants. Kabat was able to impress upon leaders at the Academy and the Research Council that rejoining HFSP as a full Member country would benefit Norway's life science research significantly and make valuable contributions to the discipline. While in Norway, Kabat was also invited to attend the biennial Kavli Prize Ceremony, a prestigious and high-profile honor. Over the years, more HFSP-supported scientists have been awarded Kavli Prizes than from any other research funding organization. Kabat met with leaders at the Kavli Foundation as well.



Pavel KABAT, HFSP Secretary-General & **Mari Sundli TVEIT**, CEO Research Council of Norway



L to r: **Hirokazu KUMEKAWA**, HFSP Deputy Secretary-General; **Pavel KABAT**, HFSP Secretary-General; **Keiko NAGAOKA**, Minister of MEXT; **Hirofumi NAKASONE**, Former Minister of Education, Culture, Sports, Science and Technology.

6-13 OCTOBER 2022 - TOKYO, JAPAN

Kabat traveled to Tokyo with Hirokazu Kumekawa, HFSP Deputy Secretary-General for extensive meetings with top leaders of the Ministry of Economy, Trade and Industry (METI); the Ministry of Foreign Affairs; the Ministry of Education, Culture, Sports, Science and Technology (MEXT); and with Members of the Japanese Diet, the legislative branch of government. In addition, Kabat and Kumekawa met with Hirofumi Nakasone, son of the late Prime Minister Yasuhiro Nakasone. They also toured the Japanese Agency for Medical Research and Development, both Kyoto and Osaka universities, and other key Japanese science institutions.

This mission to Japan was especially timely for two reasons. As HFSP prepared to launch its strategic plan for 2024-2032, it was important for Kabat and Kumekawa to better understand how proposed aspects of the plan dovetailed with Japan's frontier life science priorities. Further, the October 2022 meeting was an opportunity to meet in advance of the G7 Summit planned for Hiroshima in May of 2023.

28 NOVEMBER – 2 DECEMBER 2022 & 1-4 MARCH 2023
WASHINGTON, D.C. METRO AREA, USA

Kabat traveled to the United States twice during FY 2022 to deepen ties with U.S. MSPs, top science agency leaders at the National Institutes of Health (NIH) and the National Science Foundation (NSF). Kabat met with Sethuraman Panchanathan, Director of NSF, and Kendra Sharp, Head of the NSF Office of International Science and Engineering, and with the directors of the individual institutes that comprise the NIH. These visits were well timed, as in recent years, top leadership roles for both NSF and NIH have changed. In FY 2022, HFSPo welcomed a new U.S. MSP: Tara Schwetz, Acting Principal Deputy Director of NIH was appointed to serve on the Board of Trustees.

Kabat also met with top leaders in the Office of Science Technology and Policy (OSTP), which is a part of President Joe Biden's Executive Office. In 2022, President Biden proposed establishing ARPA-H, the Advanced Research Projects Agency for Health, which will focus on biomedical and health research under NIH. In these visits, Kabat also met with Marcia McNutt, President of the National Academy of Sciences, and secured her support for the planned International Science Summit and Scientific Symposium in Paris in 27 – 29 June 2023: Fundamental Life Science Meets Climate, Environment, and Sustainability – new bridges, new partnerships, new opportunities. In November 2022, Kabat attended at the National Science Board, and in March, he attended key sessions of the annual meeting of the American Association for the Advancement of Science (AAAS).



L to r: **Sethuraman PANCHANATHAN**, Director of NSF;
Pavel KABAT, HFSPo Secretary-General;
Kendra SHARP, Head, NSF Office of International Science and Engineering.

Table 4.1**HFSP Engagement and Consultation Missions by the Secretary-General in FY 2022-23**

Date	Country	Meetings (selected)
16-20 May 2022	Japan	AMED, SCARDA, Ministry of Trade and Industry (METI), Mr. Yasutaka Nakasone, U.S. Embassy in Japan, University of Tokyo, Mr. Hirofumi Nakasone, French Embassy in Japan, MEXT, JST, JSPS, Ministry of Foreign Affairs, CSTI, Sasagawa Peace Foundation, EU Embassy in Tokyo, RIKEN, NHPS, and STS Forum
27 May – 2 June 2022	Panama	Global Research Council (heads and presidents of major research funding agencies)
7 – 9 June 2022	France	ESM 2025, French Academy of Sciences, Ministry of Higher Education, Research and Innovation (MESRI), Japanese Embassy in France
24 June 2022	Switzerland	HFSP Trustees, Swiss National Science Foundation
26 -29 June 2022	Austria	Human Cell Atlas Annual Meeting, Austrian Academy of Sciences, IST HFSP alumni/awardees meeting, IIASA, Austria Science Fund, Science Ministry
29 August – 1 September 2022	France	Annual HFSP Awardees Meeting, HFSP Trustees, Ministry of Higher Education, Research and Innovation.
5 – 6 September 2022	Norway	Norwegian Academy of Science and Letters, Research Council of Norway, Kavli Prize Award Ceremony
9 September 2022	Germany	Trustees
14-17 September 2022	France	A strategic retreat and annual meeting of the HFSP Board of Trustees
27 September 2022	Liechtenstein	Kendermann Foundation (philanthropy)
1 – 13 October 2022	Japan	STS Forum, AIST, Funding Agency Presidents' Meeting, STS Forum Council Meeting, Kyoto University, Osaka University, AMED, JST MEXT, LDP, Mr. Nakasone, Ministry of Trade and Industry, Ministry of Foreign Affairs, CSTI, National Healthcare Policy Secretariat, Cabinet Office, Seminar, G7 office and Sherpas
23 – 25 November 2022	France	MESRI, U.S. Embassy in France, UNESCO, HFSPO Trustee, French Academy of Sciences, Embassy of Japan in France, G7 Sherpa, ANR, IYBSSD
28 November – 2 December 2022	United States	AAAS, OSTP, National Academy of Sciences, National Science Foundation (NSF), US National Science Board (NSB), HFSP Board Trustees, National Human Genome Research Institute (NIH), National Institute of General Medical Sciences (NIH), U.S. Department of State, HFSP Internal Audit Committee Chair
12 – 16 December 2022	Canada	Canada Research Coordinating Committee, HFSP Trustees, Nature Museum, International Development Research Centre, University of Ottawa, Museum of Nature, CIHR Science Council, NSERC, Royal Society of Canada, Canada Foundation for Innovation

Date	Country	Meetings (selected)
16 January 2023	Italy	HFSP Trustee, HFSP grantees and alumni laboratories
2 – 3 February 2023	France	HFSP Trustee, MESRI, G7 Sherpas, Embassy of Japan in France, Embassy of India in France, IYBSSD, International Science Council
2 14 February 2023	India	Secretary to Government of India, Ministry of Earth Sciences, French Institute in India, Embassy of Japan in India, Trustees, Department of Biotechnology, G-20 Sherpa for India, EU Embassy, Chief Science Advisor of India's government, TIFAC, HFSP awardees and potential applicants 'meetings in New Delhi, Hyderabad, Pune and Bangalore
1 – 4 March 2023	United States	NIH, NSF, OSTP, AAAS, U.S. Department of State, NASA
25 – 31 March 2023	Australia	HFSP awardees/alumni, National Health and Medical Research Council of Australia (NHMRC), Department of Industry, Science and Resources, Australian Research Council, Department of Education, Australian Academy of Science, CSIRO, NHMRC Council, NHMRC Award Dinner, Department of Foreign Affairs and Trade, Office of the Chief Scientist, Department of Health and Aged Care

4.2

HFSP'S 21ST AWARDEES MEETING—PARIS



The 21st HFSP Awardees Meeting was held from 28 August to 1 September 2022 as a hybrid event with the onsite part of the meeting taking place at the Institut Pasteur in Paris, France.

More than 300 members of the HFSP community participated in HFSP's first hybrid Awardees Meeting either in person at the Institut Pasteur, or remotely. In total, 41 HFSP awardees gave talks with 16 speakers presenting their work virtually through the event's platform "OnAir."

About 120 posters were presented over the four-day meeting; nearly 80 posters were exhibited onsite at the Institut Pasteur during very lively poster sessions. All posters were also presented on the virtual platform. One of the highlights for the Awardees Meeting included two years' worth of Nakasone Lectures by both the 2021 and 2022 HFSP Nakasone Award winners, as COVID had prevented the 2021 Nakasone Award winner from presenting in person.

www.hfsp.org/science-art-breath

This year's meeting also featured an artistic performance: Breath: An artistic journey through the lens of breath that explored how science and art can support the transformation towards sustainability.

The social programme kicked off with a welcome cocktail on Sunday evening and provided many opportunities for our awardees to exchange and inspire. Awardees enjoyed fine dining and stunning views of Paris at the panoramic Ciel de Paris restaurant in Tour Montparnasse.

4.3

STRATEGIC COMMUNICATIONS, MEDIA RELATIONS, AND SOCIAL MEDIA

In 2022, Guntram Bauer, Director of Science Policy and Communications heightened HFSP's capacity to extend the organizations outreach and enhance its visibility and outreach by adding two senior level communications professionals, D. Rachael Bishop, a veteran in the area of strategic communications and media relations and Liliana Gonçalves, an expert in digital communications and social media.

Drafting the strategic plan for 2024-2032 was a top priority for the team involving many months of revisions. Likewise, preparing country profiles to depict Member country contributions, successes, and engagement with HFSP programs was an important project for the team.

Regarding media relations, HFSP increased the number of press releases to eight and distributed to journalists in western Europe and North America, primarily through science news aggregators, EurekAlert! and AlphaGalileo. Press releases to Norwegian and South African media garnered new contacts with journalists in both countries. Three press release garnered the most interest as follows:

- **International Human Frontier Science Program Honored to Announce 2023 Nakasone Award to Rotem Sorek** – 585 page views – issue 24 October 2022
- **Fundamental Life Science Meets Climate, Environment, and Sustainability** – 513 page views – issued 30 March 2023
- **HFSP Publishes First Science Digest** – 508 page views – issued 30 October 2022.

Going forward, HFSP communications team plans to ramp up media relations efforts to further increase visibility in the press and develop a reputation for thought leadership on frontier life science research and science policy.



Increasing HFSP visibility with direct pitches to journalists through active media relations.

In social media, HFSP leveraged multiple platforms to enhance outreach and engagement. One of our accomplishments was the establishment of a new LinkedIn page, which quickly gained traction and garnered almost 400 followers in three months (Jan - Mar 2023) solely through organic posts.

The reasons behind HFSP's growing digital presence are straightforward. The communication team developed a comprehensive communication strategy that encompassed regular posting on several digital platforms and social media channels. HFSP witnessed substantial growth in its established social media pages. HFSP's Twitter account experienced a surge of 1,169 new followers in FY 2022, indicating an increased interest and engagement from the scientific community and the general public. Similarly, our Facebook page attracted 2,238 new page visitors.

Likewise, HFSP's success can be attributed to the adoption of a more informal and friendly tone. We employed engaging speech, incorporated emoticons to create a relatable, approachable atmosphere, and developed a follow-up strategy to answer external posts that tagged our profiles. HFSP adopted the use of visually appealing graphics and eye-catching elements to heighten user engagement and improve content comprehension, which allowed us to successfully foster a dynamic and interactive online presence, furthering our mission of promoting scientific research and collaboration.

Metrics showed the top performing social media posts closely focused on our science programs. (Note: impressions = number of times the content appears on followers' wall; and engagement = number of likes, comments and shares/number of impressions.)

- Posts for upcoming **HFSP Fellowship application procedures** were the top performer with 173,994 total impressions and 4,819 engagements.
- Posts for announcements of **HFSP Research Grant applications** were the #2 top performer with 49,255 total impressions and 2,186 engagements.
- **The announcement of Rotem Sorek winning the 2023 Nakasone Award** garnered considerable social media interest with 41,507 total impressions and 670 engagements.

Yet, the posts with the greatest impact on expanding HFSP's social media network were recorded in June, October 2022, and February 2023. Unlike Twitter, on Facebook, the posts with the most significant effect refer to HFSP awardees, their respective achievements, and the entry of new country members to the HFSP – this was especially true of key Member countries, including India, which has a high number of Facebook users. On Facebook, HFSP has an established community of 4,2k followers (and 4,1k likes). In this social network, the growth of the presence of the HFSP has been slower but still constant, representing a growth of about 25% compared to the previous year.

HFSP's media relations and social media presence are gaining ground as of FY 2022, and there is significant opportunity and interest for increasing visibility and engagement on our programs.

4.4

SUCCESSFUL SOCIAL MEDIA POSTS

HFSP @HFSP · Feb 6
Attention scientists from all over the world 🌍 HFSP Research Grants are open for submitting Letters of Intent! Can't wait to see your research proposals! Take a look at the application guidelines: bit.ly/40wFXwA #Hfspresearchgrants

HFSP RESEARCH GRANTS 2024
CALL FOR LETTERS OF INTENT
Application site open
Initiation deadline: 21 March 2023
Submission deadline: 30 March 2023

Human Frontier Science Program

Promote

102 200 49.3K

HFSP @HFSP · Mar 14
Attention scientists from all over the world 🌍 HFSP Postdoctoral Fellowships application opens tomorrow! It's time to pitch your creative scientific ideas into a Letter of Intent and kick off your research career with an #HFSPPostdoctoralFellowship 🚀 What are you waiting for?

HFSP POSTDOCTORAL FELLOWSHIPS 2024
CALL FOR LETTERS OF INTENT
Submission period: 15 March - 11 May 2023

Human Frontier Science Program

Promote

5 380 455 174.1K

HFSP @HFSP · Dec 16, 2022
The research developed by the HFSP awardee @almcalvo has unraveled the physical principles underlying bacterial growth in 3D, finding that as bacteria grow, their colonies consistently form fascinating rough shapes resembling a branching head of broccoli! #hfspawardeeresearch

Promote

2 14 6,386

HFSP @HFSP · Mar 27
Attention scientists from all over the world 🌍 HFSP Science Summit and Scientific Symposium is coming soon! Call for abstracts is open until 30 April. Who's in? -info: bit.ly/3JOCbqJ #hfsp #basiclifesciences #climate #sustainability #environment #sciencesummitandsymposium

HFSP Science Summit & Scientific Symposium
Fundamental Life Science meets Climate, Environment and Sustainability
new bridges - new partnerships - new opportunities
Paris | 27-29 June 2023
Human Frontier Science Program

Ministère Enseignement supérieur et Recherche and 8 others

Promote

10 25 7,970

HFSP @HFSP · Feb 3
The HFSP mission to India is coming soon! 🇮🇳 Let's foster some international collaboration in life sciences research! We are looking forward to meeting you at @Nimmunology, @DBT_CDFD, @HSER Pune and @itgn! Read more: bit.ly/3JaKaWM

SERIES SYMPOSIA BY HFSP
OPPORTUNITIES FOR FRONTIER RESEARCH COLLABORATIONS
India, 10-17 February 2023

- National Institute of Immunology, New Delhi
- Centre for DNA Fingerprinting and Diagnostics, Hyderabad
- Indian Institute of Science Education and Research, Pune
- Annual Young Investigators Meeting, Indian Institute of Technology Gandhinagar, Odisha.

Human Frontier Science Program

Promote

12 44 9,293

HFSP @HFSP · Feb 14
Are the genes that regulate a trait always the same regardless of the environmental conditions in which organisms live? The HFSP Fellow @Lufpa and colleagues explored this broad question! Find out more: bit.ly/3R55xN

Dietary stress determines which genes regulate lifespan
Research by the HFSP Fellowship Awardee Luisa Pallares, Max Planck Friedrich Miescher Laboratory, Germany

Luisa F. Pallares and Max Planck Institute for Biology Tübingen

Human Frontier Science Program

Promote

1 5 5,003

Chapter 5

Honours and Prizes



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5.0

HFSP ALUMNI WIN PRESTIGIOUS LIFE SCIENCE AWARDS

HFSP-supported scientists are regularly honoured with the most prestigious prizes in the life sciences for their ground-breaking research. In 2022, top researchers won the following prizes:

- Three HFSP research grant alumni were among the winners of the 2022 **Gottfried Wilhelm Leibniz Prize** from the German Research Foundation (DFG).
 - Almut Arneth of Karlsruhe Institute of Technology, Germany, received the award “for her outstanding research into the interaction and feedback between terrestrial ecosystems and climate change.”
 - Iain Couzin, of the Max Planck Institute of Animal Behavior and the University of Konstanz, Germany, was recognized for “his outstanding work in the field of behavioural biology, which has led to a fundamentally new understanding of collective behaviour.”
 - Eileen Furlong of the European Molecular Biology Laboratory, Germany, was awarded “for her work in developmental biology on functional mechanisms of enhancers in gene regulation.”
- The 2022 **Louis-Jeantet Prize for Medicine** went to HFSP research grant alumna Carol Robinson of the University of Oxford, UK, “for establishing mass spectrometry as a rigorous method to analyse the composition of protein complexes and their interactions with small molecules.”
- All three winners of the 2022 **Brain Prize from the Lundbeck Foundation** are HFSP alumni. Former HFSP fellow Sylvia Arber of the Biozentrum, University of Basel, Switzerland, and research grant alumni Martyn Goulding of The Salk Institute, La Jolla, USA, and Ole Kiehn of the University of Copenhagen, Denmark, and Karolinska Institutet, Sweden, received recognition “for having revolutionized our understanding of the neuronal cell types and circuits that control movement.”
- The 2022 **Kavli Prize in Neuroscience** went to grant alumni Jean-Louis Mandel and Christopher H. Walsh
- The 2022 **NIH Director Pioneer Award** was granted to grant alumna Yamuna Krishnan.
- The **Japan Academy Prize** 2022 was bestowed on Haruo Kasai and Mitsuo Kawato, two Japanese scientists who have been supported multiple times by HFSP research grants.
- The 2022 **Gruber Foundation Neuroscience Prize** was shared by grant alumni Terrence Sejnowski and Haim Sompolinsky

5.1

ROTEM SOREK HONoured WITH 2023 HFSP NAKASONE AWARD



Rotem SOREK

The 2023 HFSP Nakasone Award was awarded to Rotem Sorek for his discoveries of the diversity and operation of prokaryotic immune systems that revolutionized our understanding of virus defense and explained how related features of the human immune system evolved. In 2018, Sorek discovered that the immune system of bacteria was not solely comprised of CRISPR-Cas and restriction-modification systems as previously thought. Using an innovative computational and experimental platform he developed, he discovered dozens of previously unknown, sophisticated immunity mechanisms employed by bacteria in their combat with viruses. His breakthrough opened the field and led to a landslide of discoveries in microbiology, virology and immunology.

A major aspect of Sorek's discoveries is his demonstration that many important components of the human innate immune system evolved from defense systems that protect bacteria from phage infection. This was completely unexpected because until Sorek's studies scientists thought that our immune system resulted from evolutionary innovations of multicellular organisms. His studies explained how the human innate immune system evolved, and helped characterize new immune mechanisms in humans and other eukaryotes.

Sorek's studies also revealed new kinds of small molecules used by both bacteria and eukaryotes for intracellular immune signaling, as well as reverse-transcribed non-coding RNAs that mediate defense against phage. His studies also showed that some bacteria produce new anti-viral molecules, which pharmaceutical companies hope will lead to new anti-viral drugs just when humanity needs new disease-fighting resources. His studies have been cited thousands of times, and many of the defense systems he discovered are now studied and characterized by structural biologists, biochemists, bioinformaticians, bacterial geneticists, immunologists and microbial ecologists across disciplines.

Trained in genetics at Tel Aviv University in Israel, Sorek pursued a postdoctoral fellowship at the Lawrence Berkeley National Laboratory in Berkeley, California, USA. Beginning in 2008, he began as Senior Scientist with the Weizmann Institute of Science, Rehovot, Israel. Since 2018, he has been a Full Professor in the Department of Molecular Genetics at the Weizmann Institute of Science. In addition to his impressive achievements in basic research, Sorek is also a very prolific and innovative inventor with 40 patents and patent applications. Nine of these patents have been licensed to biotech companies.

Technologies invented in the Sorek lab were the basis for establishing three start-up companies.

5.2

HFSP GRANTEES AWARDED THE NOBEL PRIZE AND OTHER TOP HONOURS

Since 1990, nearly 8,000 researchers from more than 70 countries have been supported. Of these, 28 HFSP awardees in 32 years have gone on to receive the Nobel Prize.

Table 5.1

HFSP Grantees Who Have Won the Nobel Prize

Nobel Laureate	HFSP Research Grant	Nobel Prize
Christiane NÜSSLEIN-VOLHARD	1993	1995 (Physiology or Medicine)
Rolf ZINKERNAGEL	1994	1996 (Physiology or Medicine)
Stanley PRUSINER	1994	1997 (Physiology or Medicine)
John WALKER	1996	1997 (Chemistry)
Steven CHU	1993	1997 (Physics)
Paul NURSE	1994	2001 (Physiology or Medicine)
Tim HUNT	1992, 1997	2001 (Physiology or Medicine)
John SULSTON	1991	2002 (Physiology or Medicine)
Peter AGRE	2000	2003 (Chemistry)
Linda BUCK	1995	2004 (Physiology or Medicine)
Avram HERSHKO	1998	2004 (Chemistry)
Roger KORNBERG	1990, 1993, 1997, 2000	2006 (Chemistry)
Roger TSIEN	1995	2008 (Chemistry)
Jack SZOSTAK	2001	2009 (Physiology or Medicine)
Venkatraman RAMAKRISHNAN	2000, 2009	2009 (Chemistry)
Ada YONATH	2003	2009 (Chemistry)

Nobel Laureate	HFSP Research Grant	Nobel Prize
Jules HOFFMANN	1995	2011 (Physiology or Medicine)
Ralph STEINMAN	1996, 2006	2011 (Physiology or Medicine)
James E. ROTHMAN	1990, 1994, 2005	2013 (Physiology or Medicine)
Randy SCHEKMAN	1991, 1995	2013 (Physiology or Medicine)
Thomas C. SÚDHOF	1995	2013 (Physiology or Medicine)
Martin KARPLUS	2005	2013 (Chemistry)
Michael LEVITT	2008	2013 (Chemistry)
John O'KEEFE	1994	2014 (Physiology or Medicine)
Stefan W. HELL	2010	2014 (Chemistry)
Aziz SANCAR	1992	2015 (Chemistry)
Jeffrey C. HALL	1991, 2000	2017 (Physiology or Medicine)
Tasuku HONJO	1990	2018 (Physiology or Medicine)

Table 5.2

Additional Awards and Prizes Given to HFSP Awardees and Alumni from 2021 or Earlier That Have Come to Our Attention in FY 2022¹

Name	Nationality	Current Affiliation	HFSP Award
Academie des Sciences - Grand Prix Charles-Léopold Mayer			
Carsten JANKE	Germany	Institut Curie, Paris, France	PG 2008
Academie des Sciences - Lamonica Prize for Neurology			
Giovanni MARSICANO	Italy	University of Bordeaux, France	PG 2014
Bayer Science and Education Foundation - Hansen Family Award in Medical Sciences			
Kai JOHANSSON	Germany	Max Planck Institute for Medical Research, Heidelberg, Germany	PG 2004
Bettencourt Schueller Foundation - Prix Coups D'élan Pour La Recherche Française			
Mounia LAGHA	Algeria/France	Institute of Molecular Genetics of Montpellier, France	LTF 2010, CDA 2015
Albert WEIXLBAUMER	Austria	Institute of Genetics and Molecular and Cellular Biology, Illkirch, France	LTF 2009

Name	Nationality	Current Affiliation	HFSP Award
Breakthrough Prize Foundation - Breakthrough Prize- Life Sciences			
David BAKER	USA	University of Washington, Seattle, USA	PG 2019
CNRS - Prix Claude Paoletti			
Aline MUYLE	Belgium/France	University of Lyon, France	LTF 2018
CNRS - Silver Medal			
Valentina EMILIANI	Italy	Vision Institute, Paris, France	PG 2010, 2016
Deutsche Forschungsgemeinschaft - Leibniz Prize			
Asifa AKHTAR	Germany	Max Planck Institute of Immunobiology and Epigenetics, Freiburg, Germany	LTF 1998
Eppendorf International - Eppendorf Award for Young European Investigators			
Tanmay BHARAT	UK	Sir William Dunn School of Pathology, University of Oxford, UK	YI 2021
Ernst Schering Foundation - Ernst Schering Prize			
Aviv REGEV	Israel/USA	Genentech, San Francisco, USA	PG 2005, 2011
Gruber Foundation - Neuroscience Prize			
Christine PETIT	France	Institut Pasteur, Paris, France	RG 1999
Christopher A. WALSH	USA	Boston Children's Hospital, USA	RG 1995
Inamori Foundation - Kyoto Prize			
Robert G. ROEDER	USA	The Rockefeller University, New York, USA	RG 1992
Japan Academy - Japan Academy Medal			
Kei MIYAMOTO	Japan	Kindai University, Wakayama-ken, Japan	PG 2016
Japan Academy - Japan Academy Prize			
Atsushi MIYAWAKI	Japan	RIKEN Center for Advanced Photonics, Wako City, Japan	LTF 1995, PG 2002, 2005

Name	Nationality	Current Affiliation	HFSP Award
Keio University Medical Science Fund - Keio Medical Science Prize			
Osamu NUREKI	Japan	University of Tokyo, Japan	PG 2001
Lasker Foundation - Albert Lasker Basic Medical Research Award			
Karl DEISSEROTH	USA	Stanford University, USA	2010 HFSP Nakasone Award
Louis-Jeantet Foundation - Louis-Jeantet Prize			
Ton SCHUMACHER	Netherlands	The Netherlands Cancer Institute, Amsterdam, Netherlands	PG 2012
Max Planck Society - Otto-Hahn Medal			
Elena RECKZEH	Germany	Hubrecht Institute, Utrecht, the Netherlands	CDF 2021
Bogdan SIERIEBRIENNIKOV	Ukraine	New York University Langone School of Medicine, USA	LTF 2020
NIH - NIH Director's New Innovator Award			
Calin PLESA	Canada/Romania	University of Oregon, Eugene, USA	LTF 2016
NIH - NIH Director's Pioneer Award			
Mikhail SHAPIRO	USA	California Institute of Technology, Pasadena, USA	PG 2016
NIH - NIH Director's Transformative Research Award			
Zemer GITAI	USA	Princeton University, USA	YI 2008, 2013
Seok-Hyun YUN	Republic of Korea	Massachusetts General Hospital, Harvard Medical School, Cambridge, USA	PG 2016
Nobel Foundation - Nobel Prize in Physiology or Medicine			
David JULIUS	USA	University of California, San Francisco, USA	2017 HFSP Nakasone Award

Name	Nationality	Current Affiliation	HFSP Award
Pew Charitable Trusts - Pew Scholars in the Biomedical Sciences			
Alexander BISSON	Brazil	Brandeis University, Waltham, USA	YI 2021
Edward CHOUGHANI	USA	Dana-Farber Cancer Institute, Boston, USA	LTF 2015
Molly SCHUMER	USA	Stanford University, USA	YI 2020
Royal Society - Croonian Medal and Lecture			
Barry EVERITT	UK	Behavioural and Clinical Neuroscience Institute, Cambridge, UK	RG 1993, PG 2001
Wolf Foundation - Krill Prize			
Benyamin ROSENTAL	Israel	Ben Gurion University of the Negev, Beer-Sheeva, Israel	LTF 2014, YI 2019

¹ **Notes:** RG = Research Grant (pre-2001); PG = Program Grant; YI = Young Investigator Grant; RG-P = Research Grant – Program; RG-EC = Research Grant – Early Career; LTF = Long-Term Fellowship; CDF = Cross-Disciplinary Fellowship; STF = Short-Term Fellowship. It should be noted that until 2001 HFSP awarded Research Grants, after which subcategories of Program Grants and Young Investigator Grants were introduced. In 2020, the Program Grants and Young Investigator Grants were renamed Research Grants – Program, and Research Grants – Early Career, respectively. The Short-Term Fellowship program was terminated in 2010, and the Career Development Award (CDA) was in 2019.

Chapter 6

Finance





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6.1	FY 2022 Financial Summary	94

6.0

HFSPPO REVENUE

In FY 2022-2023, HFSPPO was funded by the generous support of 15 HFSPPO Members: Australia, Canada, France, Germany, India, Israel, Italy, Japan, Republic of Korea, New Zealand, Singapore, Switzerland, the United Kingdom, the United States of America and the European Commission. Together, they agreed on the individual and overall financial commitment to implement the Human Frontier Science Program.

During FY 2022-2023, HFSPPO officially welcomed two new Members: Norway and South Africa. They will contribute from fiscal year 2023.

In FY 2022, HFSPPO launched the Scientists for Scientists Initiative to help Ukrainian researchers affected by the war to continue their research in host institutions around the world. Since then, HFSPPO has supported proposals from 14 Ukrainian scientists and created placements abroad in the laboratories and institutes of active HFSPPO awardees. This initiative is supported by the European Commission which provided a specific additional contribution of EUR 1 million.

These revenues are complemented by other income from asset management (interest and capital gains), which in FY 2022 constituted USD 1.2 million and some recovered funds on the order of USD 0.2 million. In sum, HFSPPO's revenue for the financial year 2022 totaled USD 52.9 million.

Table 6.1

HFSP0's Revenue for FY 2022. The Table Below Shows Payments in US Dollar Equivalents at the Time of Payment

HFSP0 Revenue	received in USD equivalent
Australia	858,296
Canada	1,708,031
European Commission	5,972,040
European Commission	1,036,00
France	2,586,257
Germany	3,192,202
India	1,816,792
Israel	296,629
Italy	540,600
Japan	17,386,053
Korea, Republic of	824,329
New Zealand*	
Singapore	567,643
Switzerland	637,375
United Kingdom	2,306,480
United States of America	11,815,914
Total voluntary contributions	51,545,241
Interests & capital gains	1,154,570
Other sources	182
Other income	1,336,570
Total income	52,881,811

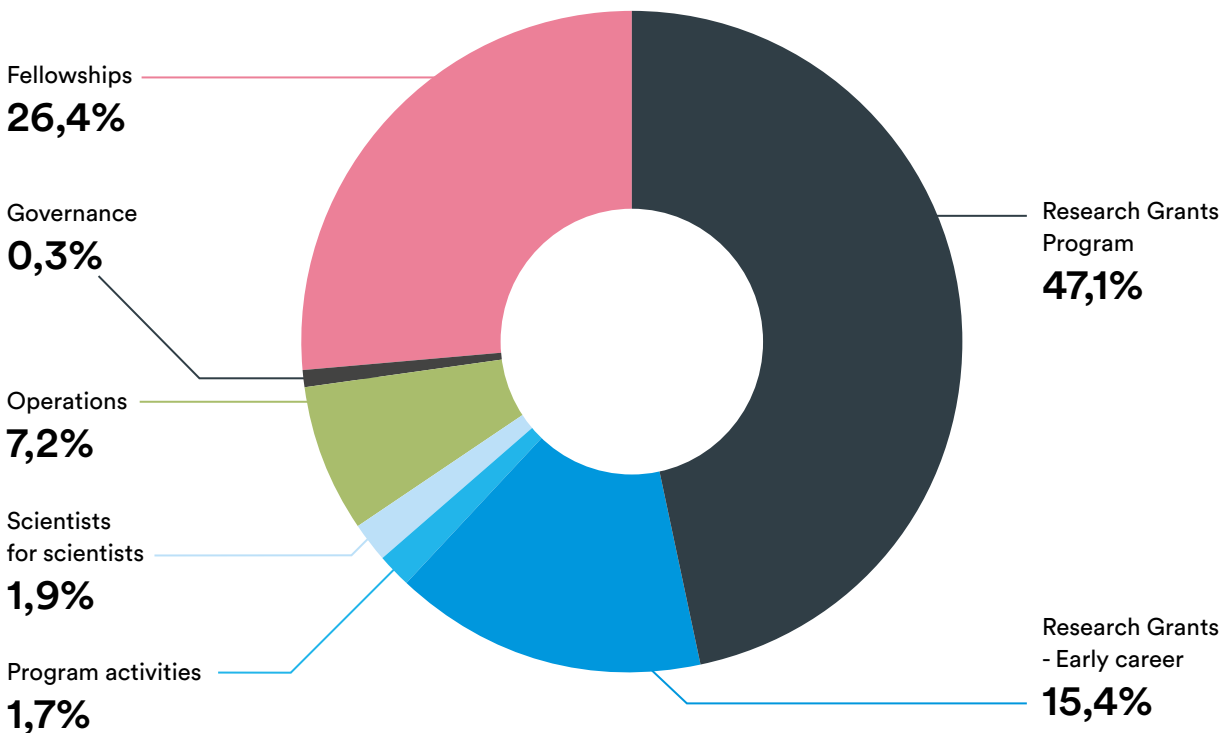
* The contribution from New Zealand of NZD 253,000 was fully collected in April 2023, shortly after the closing date.

6.1

FY 2022 FINANCIAL SUMMARY

HFSPPO was established to support and implement the scientific activities of the Program, and thus, its cost structure is geared toward a maximal support of science. In FY 2022, the scientific program accounted for 92.5% of overall expenditures. Governance and operational costs to run the scientific program stand at 0.3% and 7.2% respectively.

Figure 6.1
HFSPPO Expenditure by Type of Activity



HFSPO'S ACTIVITIES

Expenditures amount to USD 53.0 million and include:

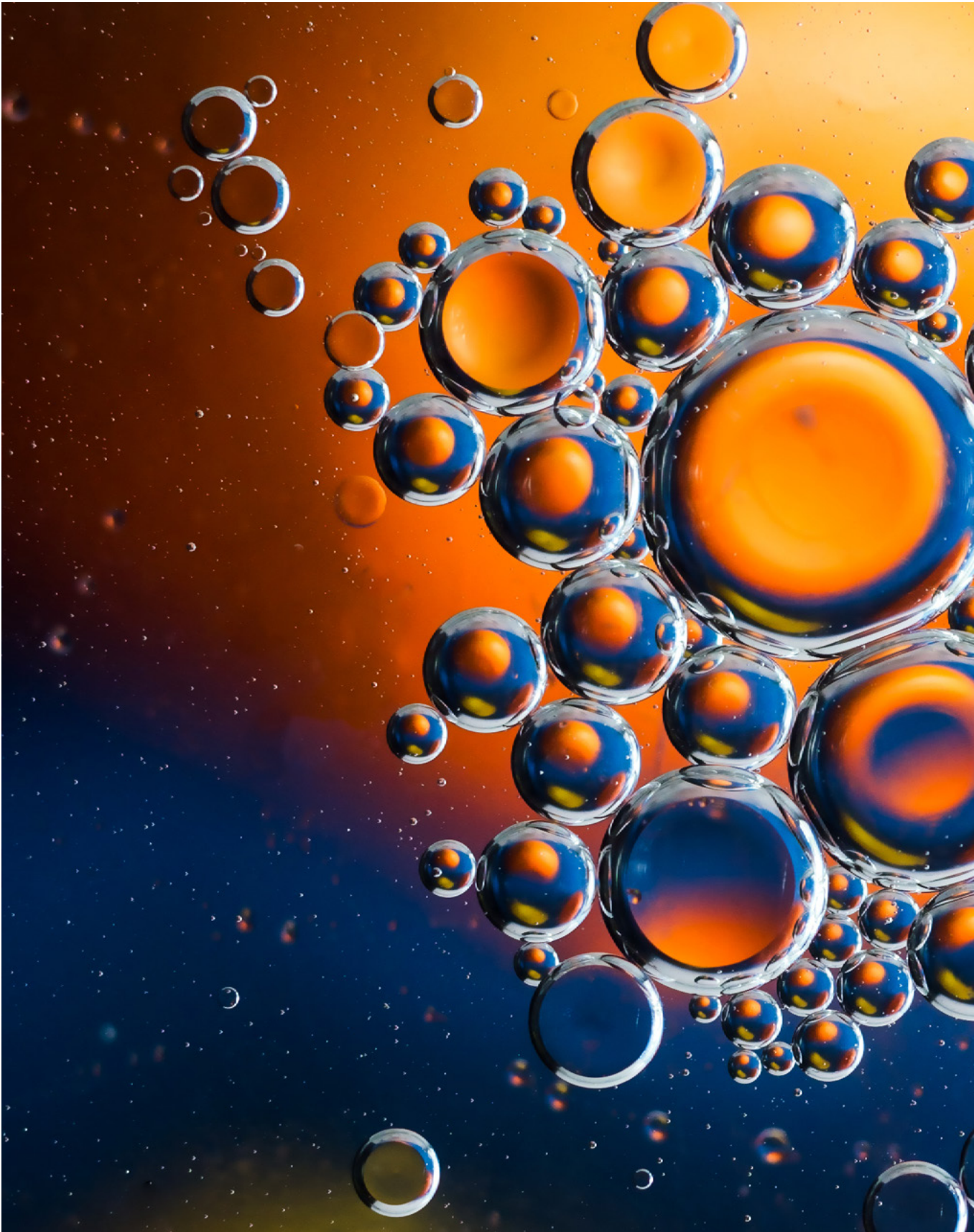
- **Program awards and program activities totaling USD 49.0 million:**
 - USD 25.0 million for Research Grants – Program
 - USD 8.1 million for Research Grants - Early Career
 - USD 14.0 million for Long-Term and Cross-Disciplinary Fellowships
 - USD 1.0 million for Scientists for Scientists Initiative
 - USD 0.9 million for related science activities
- **Governance and operational costs** amounting to USD 4.0 million

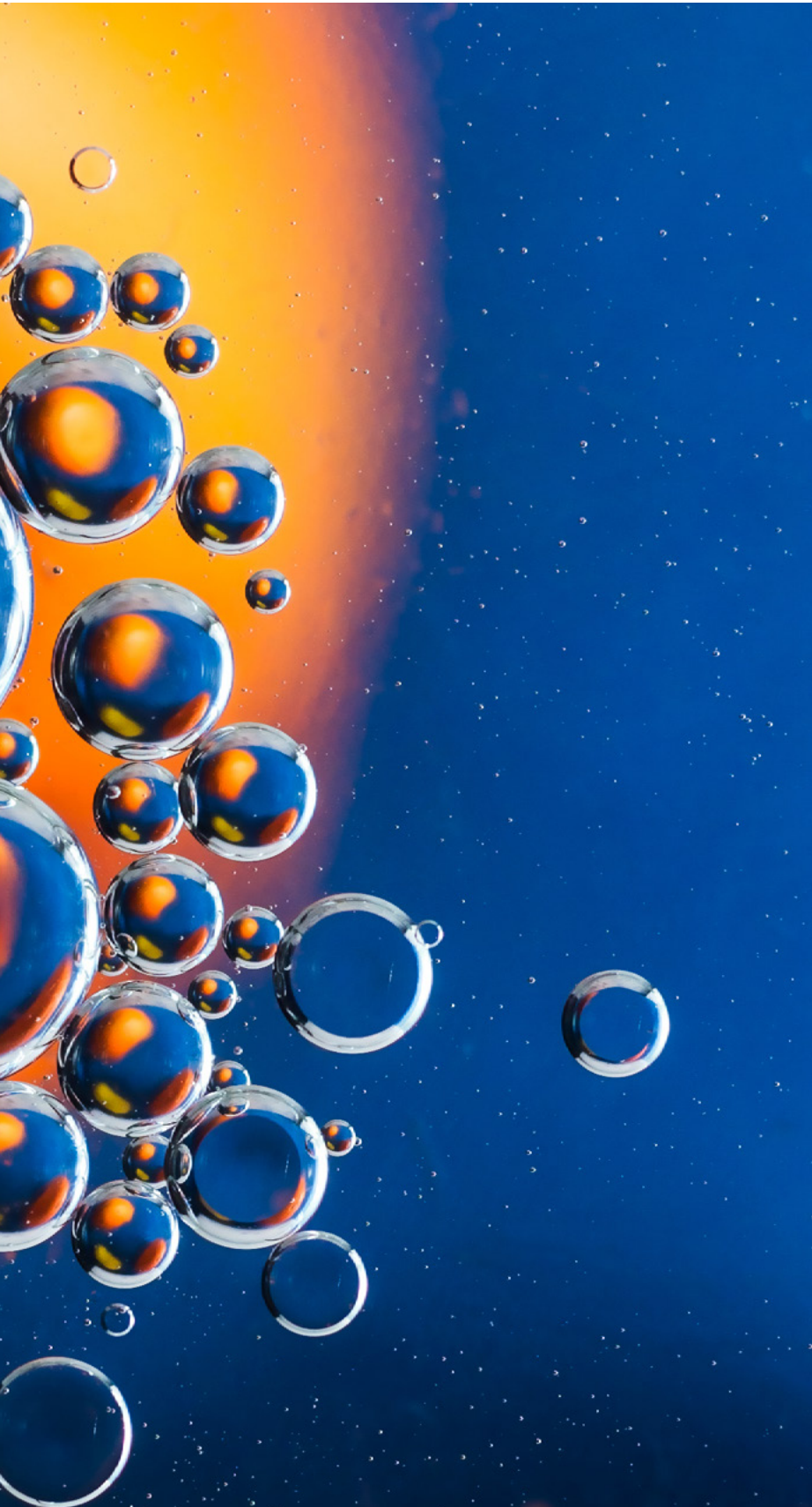
In the spirit of science without borders, HFSP brings together international teams of researchers from around the globe and supports postdoctoral fellows to move to a laboratory in a new country. Since its inception, the Program has supported researchers from 70 different countries. Last year was no exception. As shown in Figure 1.2 on page 26, awardees pursue their research in many different locations in the world.

Table 6.2

Geographical Distribution of HFSP Award Payments by Members in FY 2022 (in Thousands of USD)

Awards/geographical area	Research Grants	Fellowships	Total
Australia	1,21	413	1,623
Canada	1,945	193	2,138
European Commission	5,803	1,215	7,018
France	1,803	452	2,255
Germany	2,62	862	3,482
India	347		347
Israel	1,056	37	1,093
Italy	1,284	35	1,319
Japan	1,694	191	1,885
Korea, Republic of	117		117
New Zealand	213		213
Singapore	122	78	200
Switzerland	1,098	1,967	3,065
United Kingdom	4,489	2,151	6,64
The United States of America	8,438	6,377	14,815
Non-Member	932	4	936
Total	33,171	13,975	47,146





**International Human Frontier Science
Program Organization (HFSP)**

12 quai Saint Jean
BP 10034
67080 Strasbourg CEDEX
France

e-mail: info@hfsp.org

website: www.hfsp.org

Japanese website:

amed.go.jp/program/list/20/01/008.html

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National Science Foundation (NSF)



**International Human Frontier Science
Program Organization (HFSP)**
12 quai Saint Jean - BP 10034
67080 Strasbourg CEDEX - France
e-mail: info@hfsp.org
Website: www.hfsp.org