International
Human Frontier
Science Program
Organization

HFSPO Strategic Plan 2024 – 2032

Frontier Life Science in a Time of Change

The Human Frontier Science Program

The Human Frontier Science Program (HFSP) supports internationally collaborative scientific to pioneer new frontiers in the life sciences. Preference is given to investigations that involve innovative, high-risk basic research, particularly those that support and train independent, young investigators, beginning at the postdoctoral level. HFSP is implemented by the International Human Frontier Science Program Organization (HFSPO), a voluntary, international consortium of numerous Member countries plus the European Commission. First formed in 1987 by the G7 nations, HFSPO became operational in 1990. The HFSPO Secretariat is based in Strasbourg, France, and Annual Awardees Meetings are rotated among Member countries. Since the organization's inception, thousands of researchers have been awarded financial support to lead cutting-edge science and more than two dozen researchers have gone on to receive Nobel Prizes. These research investigations have led to advances that have greatly benefitted humanity.

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Foreword

FRONTIER LIFE SCIENCE AT THE CROSSROADS

We are at a critical point in the history of frontier life science research. Not since the 1950s has the public become so aware of, and so in support of, scientific research as a vital enterprise for humanity. The pandemic cemented in our minds that basic life science is essential for humanity's survival, public health, and resilience in the face of global challenges. The exceptional vaccines and research on COVID-19 that scientists rapidly deployed were only possible given the groundbreaking discoveries uncovered by basic, frontier life science decades earlier. Scientists delivered the needed response to this global wake up call, and citizens and government leaders realized that frontier life science research is one of humanity's most vital, most creative assets. Protecting and growing this capacity is paramount.

In this regard, the International Human Frontier Science Program Organization (HFSPO) plays a critical role and offers a unique value proposition. What do we mean by this? HFSPO specifically supports cutting-edge basic research for which there are no preliminary studies or data, and all of our research projects involve international collaboration. We assume that failure may ensue, but we're willing to take high risks for the possibility of high rewards. This is how we define frontier life science research, and this is what we solicit and support. Further, HFSPO operates as a central repository for its Member countries; each contributes to the international organization with no guarantee its scientists will be funded, but when they are awarded, the funds have no geopolitical earmark, no governmental requirements.

HFSPO envisions expanding its core research support programs to ensure that frontier life science can continue to evolve, inviting a diverse portfolio of cutting-edge research and globally diverse scientists, and forging new ways to foster creativity in exploring new horizons. But to embrace this vision will require a commitment to reinforcing our core programs and inviting new energy and ideas — because in the 30 plus years since HFSPO was founded most aspects of frontier life science have changed.

Shigekazu Nagata,
HFSPO President and Chairman of the Board of Trustees

Pavel Kabat,
HFSPO Secretary-General

EVERYTHING HAS CHANGED – WE MUST RESPOND

The frontiers of life science have extended to the far edges of our imagination. HFSPO was conceived in 1987 by the leaders of the G7 nations and became operational in 1989 with the establishment of its Secretariat in France. Since then, our community has grown from seven Member countries to 16 plus the European Commission. Around the world, agencies, universities, and research institutions support HFSPO programs, and more than 8,500 HFSP grant and fellowship awardees have driven our success, 29 of whom have won Nobel Prizes. These scientists pioneered the frontiers and pursued their curiosity. As a result, we have a large, robust research enterprise of global acclaim. Scientists supported by HFSPO have pioneered groundbreaking research for the benefit of humankind. Many years from now, science historians will probably call the 21st Century the "Age of Biology." For perspective, in the 1990s, frontier life science research focused primarily on molecular biology. Today's novel collaborations bring together transdisciplinary teams of scientists pairing, for example, molecular biologists, neuroscientists, and ecologists with physicists, mathematicians, chemists, computer scientists, anthropologists, behavioralists, and all manner of engineers.

The frontier life science enterprise has also evolved in response to major global changes in economics, environmental degradation, data science and telecommunications, and shifting geopolitical alliances. HFSPO was first conceived in the late 1980s by a select array of leading industrialized nations that had invested deeply in scientific research since the 1940s, which continued through the Cold War. Thus, it was a natural extension of their momentum to fuel a global organization based on scientific excellence, interdisciplinary research, and international collaboration with the goal of driving frontier life science through highly competitive international research support mechanisms. However, today, in 2023, the world of life science has become a much wider, far more complex enterprise, one that is full of new challenges and opportunities. HFSPO must respond.

LOOKING BACK TO CHART THE BEST PATH FORWARD

Over the last four decades, the global economy has reshaped much of the world. Now, numerous countries are significant players in the life sciences, and they are eager and ready to participate and contribute to the HFSPO community. At the same time, the volatility of today's global economy against the backdrop of changing geopolitical alliances means that nearly all national governments feel the highs and lows of economic variability, a reality that has influenced many science funding agencies and universities to become cautious about investments. For this reason, it is even more important that the scientific enterprise operates strategically; HFSPO is well positioned to direct funds to research efforts that maximize return and creativity.

The emerging frontiers in life science are also shaped by the great shifts in technological change, including the growth of data science and artificial intelligence, that allow us to conduct research and analyze large amounts of data at scales that were previously impossible. Advances in nanotechnology

and robotics similarly are opening areas in bioengineered solutions for human health. Global telecommunications have brought humanity to a highly interconnected state, such that calls for greater inclusion of diverse peoples and ideas are now felt round the world.

Truly, the world has changed. Taking all these profound realities into account, HFSPO has crafted an ambitious Strategic Plan for 2024-2032, a nine-year period that covers three implementation and fiscal triennia. Throughout our planning process we were guided by the following questions: How do we, as the pre-eminent frontier life science community, see our role for the future? How do we create new mechanisms for identifying the next frontiers? And how do we, as an organization, during a time of profound challenge, evolve our Shared Values and aim for new, more inclusive ambitions to deliver on our mission?

Ultimately, the question is: Are we willing to go where the newest frontier science compels us to explore? It is a philosophical question as much as an economic one. As a self-governing entity, bound to deliver true frontiers of life science, but not subject to any political priorities, HFSPO has developed a clear vision for our future. Unified in purpose and committed to frontier life science, we see HFSPO's future as based in strategic, evolutionary growth.

Outcomes from the Strategic Plan

- **Strengthening** HFSP's core programs by awarding more frontier research grants and fellowships that meet our highest criteria and globally competitive standards.

- **Accelerating participation of scientists** from HFSPO Member countries that, so far, have been underrepresented in HFSP awards.

- **Creating novel opportunities**, across the HFSP-supported frontier science community to conceive and propose new system-level interdisciplinary research projects.

- **Diversifying the HFSPO Membership** to include countries that subscribe to our Shared Values, and peoples, cultures, ideas, and research institutions to be true to our mission.

- **Proving that people and countries can cooperate internationally** for decades, including evolving and growing as an organization.

- **Evolving our Shared Values** of scientific excellence, interdisciplinary approaches, and international collaboration to achieve a diverse HFSPO culture based on equity, inclusion, and sustainability — including, bringing greater awareness to potential unconscious bias.

Frontier Research: Transdisciplinary & Collaborative

Frontier research continuously evolves, branching out into new directions pushed by novel technology, changing paradigms and ingenuity. HFSP research reflects our statutory objectives regarding scientific excellence, high-risk, high-reward frontier science, diversity and inclusion, international collaboration, and interdisciplinary approaches.

Conversations between brain and vasculature

Christine Cheung, Lee Kong Chian School of Medicine, Nanyang Technological Univ., Singapore, **Kyle Loh**, Inst. for Stem Cell Biology & Regenerative Medicine, Stanford University, USA. Comprised of billions of neural cells, the brain is responsible for how we perceive, react to, and remember the world. The research focuses on blood vessels that permeate the early brain and have important roles in fostering brain assembly. Scientists once thought blood vessels only supplied oxygen and nutrients to organs; this research indicates they may serve as a 'signaling center' controlling the arrangement of neural cells during brain assembly.

Molecular circadian clock as a causal mediator of sleep-regulated neurophysiology and cognition

Robbert Havekes, Groningen Inst. for Evolutionary Life Sciences, Netherlands, **Jae Kyoung Kim**, Korea Advanced Inst. of Science and Technology, Daejeon, South Korea, **Sara Aton**, Molecular, Cellular and Developmental Biology, Univ. of Michigan, USA **Matias Zurbriggen**, Inst. Synthetic Biology, Univ. of Düsseldorf, Germany. Sleep deprivation disrupts memory consolidation, and alters gene transcription in the cortex and hippocampus. Deficits in memory are caused partly by mis-regulation of the molecular circadian clock. Sleep and wakeful states cause widespread, simultaneous changes in transcription, translation, neural activity, neuromodulation, and hormone release, which makes these issues hard to analyze. Using optogenetic tools, they rapidly up- or down-regulated individual clock genes in vivo, in a circuit-specific manner, independent of the animal's behavioral state.

Navigating land and water: how centipedes walk and swim

Auke Ijspeert, Biorobotics, Inst. of Bioengineering at EPFL, Switzerland, **Akio Ishiguro**, Research Inst of Electrical Communication, Tohoku Univ., Japan, **Emily Standen**, Dept. of Biology, Univ. of Ottawa, Canada. Animals move adaptively in various environments by flexibly coordinating their body and limbs. Animals, such as salamanders and certain fishes, possess outstanding adaptability: they can move between qualitatively different substrates, i.e., land and water, by flexibly changing their body coordination patterns in real time. This research offers insight for new robotics.

From swarm intelligence to living buildings. Novel concepts of managing internal climates

Lakshminarayanan Mahadevan, Applied Mathematics, Organismic & Evolutionary Biology and Physics, Harvard Univ., USA, **Eugene Marais**, Dept. of Entomology, National Museum of Namibia, **Sanjay Sane**, National Centre for Biological Sciences, Bangalore, India, **Rupert Soar**, School of Architecture, Design and Built Environment, Nottingham Trent Univ., UK, **Scott Turner**, Dept. of Environmental & Forest Biology, SUNY College of Environmental Science & Forestry, Syracuse, USA. Biologists, mathematicians and engineers uncovered secrets of the world's most spectacular animal-built structures, the mounds of southern African termites, Macrotermes. The mounds do not "air condition" the nest, but are the lung for the underground colony. They offer a novel means of capturing turbulent winds to do work and reflect building behavior that is far more sophisticated than ever realized. The project forged new frontiers in the physics of using turbulent wind, revealed largely unexplored biology of the termite brain, and shed light on collective cognition in the termite colony.

Is memory in the brain similar to material memory?

Mathew Diamond, Tactile Perception and Learning Lab, International School for Advanced Studies, Italy, **Nathan Keim**, Dept. Physics, Pennsylvania State University, USA, **Omri Barak**, Faculty of Medicine and Network Biology, Technion Israel Inst. of Technology, Israel. The brain's capacity to store and retrieve information is the target of enormous research efforts. Seemingly unrelated research in physics has begun to focus on information storage and retrieval in non-living systems. For instance, a crumpled nickel-titanium wire spontaneously reconfigures into its remembered shape — a paperclip — upon heating. The project posits that memory dynamics being discovered in non-living systems are less remote from brain memory than might be supposed.

Is Earth's atmosphere a living, breathing system?

Jackie Goordial, Dept of Environmental Sciences, Univ. of Guelph, Canada, **James Bradley**, School of Geography, Queen Mary Univ. of London, UK, **Elizabeth Trembath-Reichert**, School of Earth and Space Exploration, Arizona State Univ., USA, **Chris Greening**, Biomedicine Discovery Institute, Monash Univ., Australia. Is the Earth's atmosphere a living, breathing ecosystem? The research looks at how communities of microorganisms interact to maintain diversity and mediate biogeochemical cycling in the environment. In particular, they focus on environments at the extreme that are undergoing rapid change, such as permafrost soils.

The HFSPO Commitment to Frontier Life Science

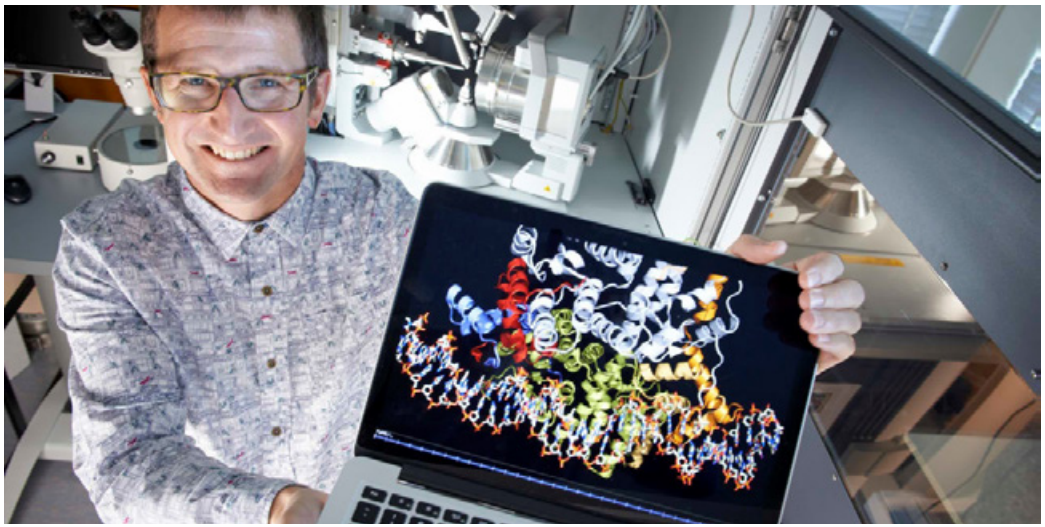
HFSPO has successfully supported extraordinarily creative thinkers, brilliant early career life scientists, and built an organization that honors our shared values. It is a testament to our approach that in just over 30 years, 29 HFSP research grant awardees have gone on to win Nobel Prizes and numerous other prestigious prizes and awards.

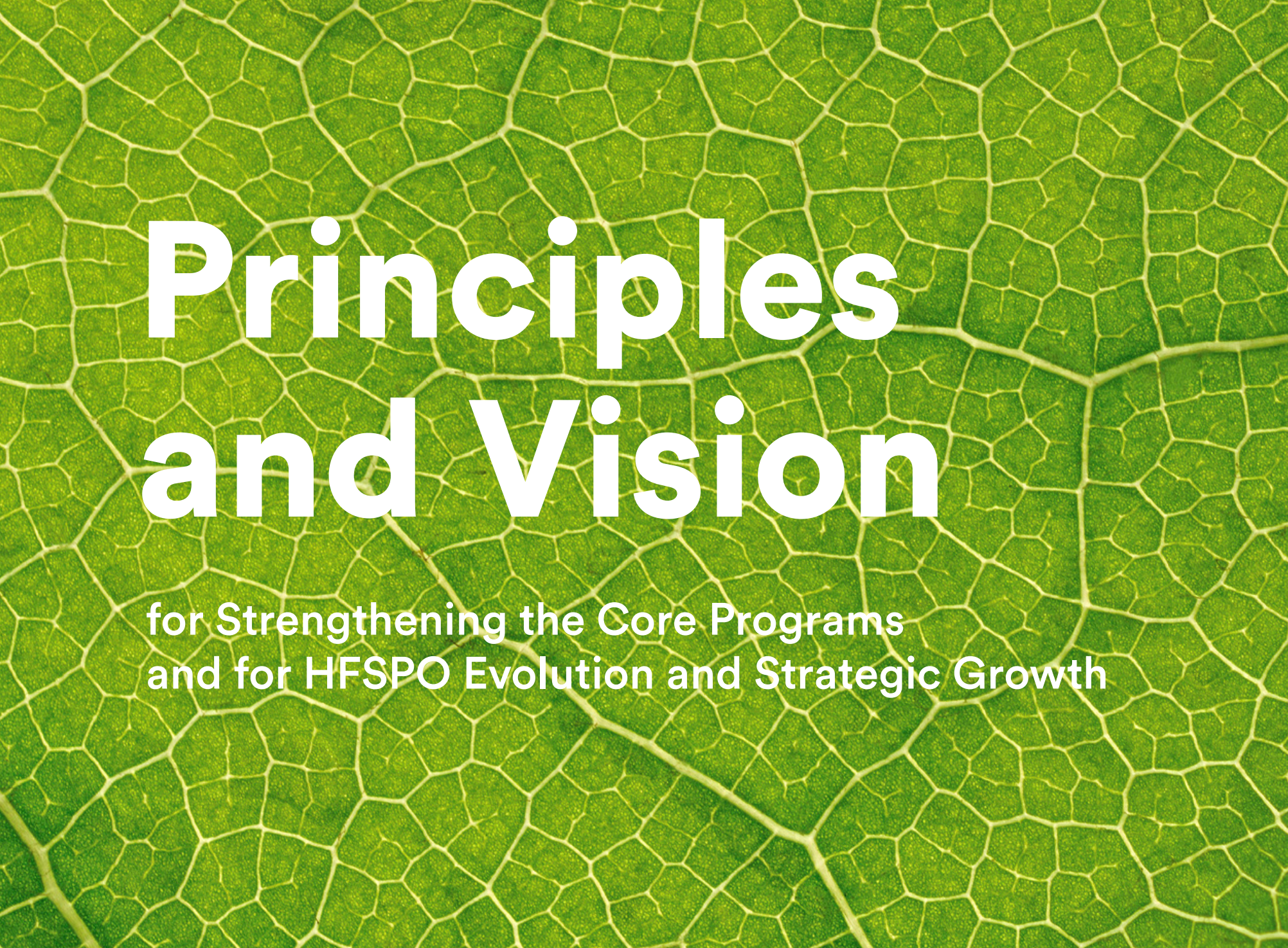
Many organizations facing the conundrum of strategic planning for an uncertain future would opt for a conservative approach to seek safety, but HFSPO is committed to excellence above all, to sparking outstanding, original research, and to bridging oceans to foster international and intercontinental collaboration. We are different.

HFSPO makes considerable sacrifices to achieve our mission. We are not looking for 'good' or even 'outstanding' research. We seek rare insight, totally original research that pioneers new dimensions in the life sciences. HFSPO succeeds because our community is willing to live at the edge. But our work can only be accomplished with the trust and commitment of our Member countries, with the dedication of the Members of our Review Panels who commit hundreds of hours every year to assessing grant and fellowship proposals, with the hard work of HFSPO's lean team, and with the leadership of HFSPO's governance structure.

HFSPO has crafted this strategic plan to safeguard our unique community and Shared Values through four principles that will drive the change we need in order to thrive amidst global challenges: vitality, diversity, connectivity, and foresight. The strategy employs three goals that reinforce each other while reaching for ambitious heights.

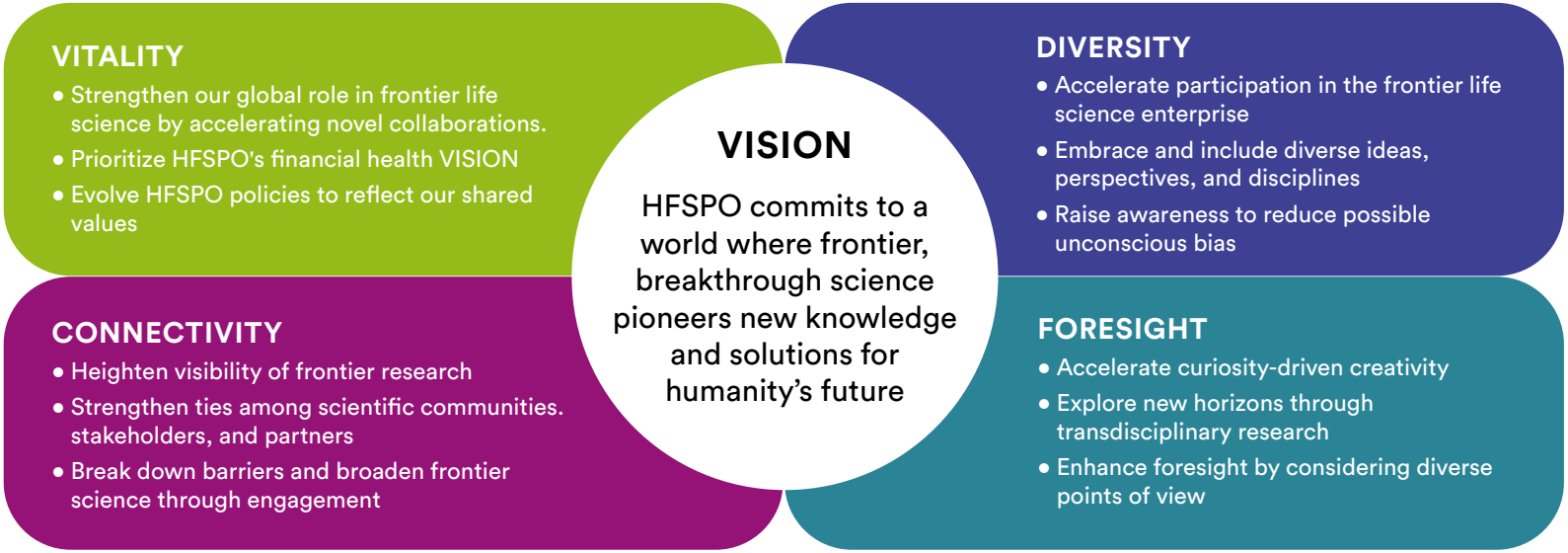
> "HFSPO firmly believes that the greatest breakthroughs and creativity often lie beyond the reach of experience — indeed, discovery thrives at the far edge of our courage."
>
> Pavel Kabat





Principles and Vision

for Strengthening the Core Programs and for HFSPO Evolution and Strategic Growth



VITALITY:

Many inspiring leaders talk about resilience as key to survival in a world that has become increasingly complex, challenging, and stressful, but for an organization to do good in the world in the face of such complications, it is not enough to be merely resilient. It may be necessary to fortify an organization, introduce new strength, so that it can rise above challenges and continue its successful trajectory.

For example, in recent years, HFSPO has observed two imperatives regarding the research grant and fellowship proposals we receive. First, each year there is a percentage of proposals that are not really eligible for consideration — either they are not sufficiently frontier in nature, or they don't meet our standards for international collaboration. In other words, we have a significant volume of applications, but many are not necessarily a good fit for what we want to support. The solution to this problem is improved outreach and communications.

Secondly, of those applications that are truly outstanding there is a growing gap between the number of truly worthy frontier life science proposals that deserve to be funded vs. HFSP's ability to support them. We call this a "frontier gap" because the leading edge of discovery is outpacing the available resources needed to support the research.

For HFSPO to address both of these problems, while promoting international collaboration that will welcome countries previously disadvantaged from participating in frontier research, we need to think about the life of our organization and what HFSPO needs to thrive. Vitality must be our key word going forward. We need to plan for our

future and prioritize HFSPO's financial health, while providing more equitable benefits sharing across the organization. We can only ensure the vitality of our core programs and operations by being able to fund the projects that meet our frontier science standards, so HFSPO remains attractive for scientists submitting highly original and innovative proposals.

Inflation, fluctuations in exchange rates among currencies, and national cutbacks to science funding are roadblocks to financial organizational health. But to ensure the longevity of HFSPO, we have to be proactive, strategic, and visionary in our efforts to sustain HFSPO's future operations. The pandemic showed the world that contingency planning with scenarios helps organizations become more agile and adaptive. And well-funded organizations have many more options when it comes to withstanding shocks. By prioritizing vitality, we may need to develop new organizational capabilities in order to continue on a path of success. By nature, HFSPO is an exploratory organization, it is imperative that we revisit our philosophical basis from time to time. We can, and should, assess our policies and practices and determine whether they reflect our Shared Values and mission and whether they help us develop organizationally. We will develop and adopt new policies, for example, in the areas of environmental sustainability and diversity, equity, and inclusion.

DIVERSITY:

Partnering with a diverse array of people, ideas, and research institutions grounds the frontier life science enterprise and stimulates insight, creative thinking, and greater understanding on many levels. International collaboration has always been one of HFSPO's core, shared values. But now we are called to go deeper. Diversity, equity, and inclusion of those who have historically been disadvantaged is to the 21st century what liberty, fraternity, and equality were to the Enlightenment of the 17th and 18th centuries — these are foundational principles that will forever change our society, our thinking, and how we conduct HFSPO business.

The global economy has widened the playing field and there are many more countries interested in, and capable of, driving global life science as a part of HFSPO. If we are to truly push forward the frontiers of life science, we need to fully embrace a wide definition of diversity, equity, and inclusion. We need to more equitably share the financial burden as well as the benefits of Membership. HFSPO needs the full range of talent, ideas, and cultural perspectives among our scientists, awardees, reviewers, staff, and governance leaders. The frontiers in life science are in transdisciplinary research, a way of working that is strongest when diverse contributors, ideas, and disciplines are engaged. Diversity is key to the success of our frontier research and to HFSPO organizationally as we need the participation, good will, and support of all of our Member countries. As a principle, valuing diversity also requires a high level of respect and willingness to engage with different people, their perspectives, and their experiences.

CONNECTIVITY:

Connectivity is vital to the future of HFSPO as we do not exist as a static institution in a specific place for all intents and purposes. While the Secretariat is based in Strasbourg, France, HFSPO operates across borders, across continents, largely in the minds and hearts of scientists and the representatives of our Member countries.

We believe open science brings scientific communities together enabling a greater degree of frontier, collaborative research. Our annual Awardees Meetings move to new locations every year. Our communications and engagement activities are largely virtual, and our science proceeds in a decentralized manner in laboratories around the world.

Now more than ever, as we function so much online, it is important for HFSPO to prioritize engagement activities with each other, our stakeholders, and our Member countries, through online and in-person gatherings. Regular contact is needed to deepen relationships, and it is essential if we are to 'walk the talk' of frontier life science.

We need to speak with each other, see each other, share ideas, and reinforce each other in our work and mission, whether that be virtually or in person. HFSPO runs the risk of becoming isolated and lacking in support if we do not communicate frequently and effectively and engage our stakeholders, national agencies, and those who share our thirst for curiosity. We need to apprise each other of how the frontiers of life science are moving and changing. In order for HFSPO to strategically evolve, it is important to remain open to trying new ideas, such as our frontier workshops, that bring together scientists so they can brainstorm new ideas that reinvigorate our work.

Connectivity is essential in a world beset by global challenges, and as we serve to nurture the life science community at the frontiers, we must pursue strategic engagement through select international summits, workshops, communications channels, partnerships with other organizations, and similar opportunities that will further fortify our core mission. Thankfully, in today's world, communications and engagement have a multitude of available tools that will serve HFSPO well.

FORESIGHT:

HFSPO was conceived to be a dynamic organization fueling opportunity for frontier scientists to dig deep into their curiosity and deliver exceptional research grant and fellowship proposals. HFSPO exists today because Japanese Prime Minister Yasuhiro Nakasone and his fellow leaders of the G7 nations had the foresight, as well as the political will, to make their vision a reality. With the approaching fall of the Berlin Wall there was a new energy in the air, public opinion was again receptive to international collaboration. Thus, it is no accident that Nakasone and the scientists who originally envisioned HFSPO encouraged the G7 leaders to fund a global organization that would support frontier life science for the benefit of humankind.

Having foresight does not mean having definitive answers, and HFSPO certainly does not operate through top-down or prescriptive processes. Rather, it is having a collective intelligence and the culture to sense change, the curiosity to scan the horizon for emerging trends, and the humility to realize that the future is only partly visible. We cannot predict it. But we can expand and reframe our thinking and consider new scenarios and plausible developments. In this regard, HFSPO takes seriously the opportunity to explore and probe what might be possible. To realize this part of our charter, HFSPO is committed to remaining open to new ideas that spur new levels of international collaboration and curiosity-driven breakthrough thinking that expand our peripheral vision.

Taken together, these four principles — **vitality, diversity, connectivity, and foresight** — will provide HFSPO with the focus to energize our community so we can tackle the challenges ahead with vigor and results. Using these four principles, the 2024-2032 strategy defines its focus and priorities: to strengthen and widen our support for international, collaborative frontier life science projects, to assure more equitable benefit-sharing among Members, to become a diverse and globally inclusive organization, and to create a well-balanced, level playing field of HFSPO support for Members. The new 'accelerator program' to be implemented as a part of HFSPO's strategy is a first step in our solution for tackling these priorities.

In this document, we detail three goals: **Expand Frontier Science, Strengthen the Core Program Through Engagement, and Become a Globally Inclusive Organization**. These goals provide a framework that both guides the organization forward and leaves room for evolution, exploration, and creativity. This is intentional because HFSPO must continue to operate both for the good of the science and also for its community. The organization must evolve and grow so it can provide value expected by the Member countries, support scientists who are driving breakthrough science from the ground up, and boost those early career awardees who are entering the field just as it is undergoing rapid change. HFSPO is in a unique position to deliver extraordinary benefits through cutting-edge frontier research, assets that are needed by all of humanity. Through balanced evolution and wise growth we can provide for that vision.

HFSPO's Strategic Goals 2024 – 2032

The architecture of the HFSPO strategy involves one goal that is the overwhelming priority and two secondary goals that are essential if we are to realize our main focus. Thus, Goal #1 is to Expand Frontier Science and this will be achieved by Goal #2 Strengthen HFSP through Engagement and by Goal #3 Become a Globally Inclusive Organization.

GOAL 1: EXPAND FRONTIER SCIENCE

Closing the "frontier gap" and reinvigorating HFSPO's leadership and niche in supporting truly frontier life science.

HFSP research grants and fellowships are vital to support frontier life science research because they drive breakthrough discoveries and set the pace for advancing knowledge for all our Member countries. We must ensure their vitality and further grow these core programs. That is paramount. All other considerations in our strategy flow from this top priority.

Each year, HFSPO receives hundreds of research grant proposals involving thousands of researchers in intercontinental teams and hundreds of proposals for fellowships by postdoctoral researchers. Yet, a range of economic, financial, and geopolitical challenges are impacting our core programs and producing disturbing trends.

First, too many truly exceptional frontier science proposals for research grants and fellowships cannot be currently supported because there is simply not sufficient budget to provide those awards. Each year, our review committee identifies about 40 collaborative research grant applications that propose truly outstanding frontier science and merit HFSPO support, yet we can only fund about 30 grants per year, or 4% of all applications. That means that on average up to 10 exceptional frontier research proposals go unsupported. This represents a high percentage of pioneering science that is not in a position to be pursued. To close this "frontier gap," and subject to availability of resources, we aim to gradually increase the number of awarded research grants up to 40 by the end of the first triennium (2026) of our new strategy.

Parallel trends for fellowships show an even more troubling situation. In 2016, the review committee identified 124 proposals worthy of support, but we could only support 75. In 2021, out of 91 fellowship proposals that merited funding, we could only afford 58. On average, each year, 25 outstanding early career scientists cannot be supported due to budgetary constraints. This is deeply concerning, as providing fellowships to launch the next generation of frontier researchers is critical to maintaining the health of the frontier life science enterprise. HFSPO proposes gradually increasing fellowship awards to about 70 by 2026.

Over 30-plus years, the HFSPO financial means have not kept pace with the times and with demand. We are a lean organization, as befits our culture. Currently, HFSPO is dedicating fully 92% of its total budget to funding our core programs: research grants and fellowships, yet the "frontier gap" widens. The new 2024-2032 Strategy aims to motivate HFSPO Members to fortify our programs so the community as a whole will pull together despite the challenges we face and continue to fulfill our mission.

It is important that we make that commitment, because HFSPO core programs provide a unique value proposition for Member countries and scientific communities across a wide range of disciplines. A new accelerator program will significantly strengthen the research grant program, resulting in more support for research grants, specifically for those Member countries, which, so far, have not been able to realize sufficient benefit from HFSP.

HFSPO needs to strengthen its core programs for another reason as well. In today's world, scientists have access to

multiple funding sources for grants and fellowships. While few national organizations support the kind of high-risk, high-reward frontier investigations that are at the heart of HFSPO's scientific focus, none of them can support truly international research. HFSPO needs to heighten its visibility so that scientists planning truly frontier research appreciate the value of our programs and apply for HFSPO support. Supporting frontier research requires the willingness to accept discovery and exploratory proposals and a critical mass of research capable of developing new frontiers. If we want frontier life science to thrive, we cannot permit stasis to take hold.

HFSP research grants and fellowships have always built bridges among different areas of life science research by evolving research directions and encouraging new teams to be open to novel problem-solving approaches. In thinking about solutions needed for the future, the life sciences provide an important component, but it is HFSPO's view that what is needed are greater transdisciplinary, collaborative efforts. Together, they may optimize problem-solving research by integrating multiple perspectives that advance sustainable development transitions.

We will:

- Maintain HFSPO's reputation for excellence and leadership by working with our Member countries to provide for the longevity of frontier life science research and of our core programs.
- Engage with more potential new Member countries from around the world, advise their scientists how to submit successful research grant proposals and fellowship applications.
- Close the "frontier gap" up to a maximum extent possible by awarding more research grants and fellowships.
- Increase the visibility of HFSP Research Grants and Fellowships through targeted outreach campaigns and multiple channels to encourage the world's best scientists to submit highly competitive applications to our core programs.

GOAL 2: STRENGHTEN HFSPO THROUGH ENGAGEMENT

Create opportunities for discussion and exchange that foster breakthrough leaps in frontier life science and connect all HFSPO Members, stakeholders, and the community as a whole.

HFSPO is growing, adding new Member countries and diverse perspectives. We are also decentralized across time zones. As a global organization undergoing considerable change, it is imperative that HFSPO invites conversation and communication and provides a culture so new Members feel welcome as valued contributors and long-standing Members share their knowledge and insight of HFSPO such that all may experience successful and beneficial participation.

One of the primary objectives is ensuring that HFSPO attracts the best frontier science possible. To achieve this, we need to strengthen our HFSP Research Grants and Fellowships by creating outreach and engagement activities that help applicants hone their proposals so that those with truly pioneering ideas stand out in the application process. Where proposals most often fail is in misunderstanding HFSPO's focus on interdisciplinary, high-risk, high-reward basic science and the requirement for international collaboration. In other words, many applicants do not understand how HFSPO is different than other programs. The solution for this problem is increasing communications, engagement, and outreach to contact the right researchers and their communities. Thus, improving our engagement and making it more strategically targeted is not a 'nice to have' aim, but a 'must have' if we are to strengthen our core programs.

Participation in essential engagement programs, such as our Annual Awardees Meeting, is not just offering time for casual conversations, but a unique opportunity to network professionally that helps to inspire important brainstorming and conversations among brilliant minds. Knowing this truth, HFSPO envisions invigorating applications to our HFSP Research Grants and Fellowships by stimulating engagement with the wider, transdisciplinary scientific world through unique opportunities, such as

frontier workshops, international summits, communications, and other pilot programs, including our proposed accelerator initiatives.

Our range of research grants shows that breakthrough science can proceed in many ways. It may be transdisciplinary in nature, pairing biologists, mathematicians, chemists, material scientists, plant scientists, and engineers together. The breakthrough may result from studies that crosse trophic scales from microscopic organisms, such as plankton, to top predators. Breakthrough life science may also go hand in hand with the development of new technologies and methods. Whatever the approach, what is needed are ways for top scientists to come together and envision creative research.

Through select initiatives, HFSPO will bring together the world's most innovative, curiosity-driven scientists to reflect on, and pioneer, the newest frontiers in life science. Science benefits and flourishes when there are a range of fora for scientists to engage with each other, discuss, debate, and brainstorm. The life of science does not solely exist in the laboratory, but also in the musings and gatherings that go beyond what conferences and panel discussions can provide.

We will:

- Create an accelerator program to fully engage all Member countries by encouraging existing HFSP Research Grant awardees to invite investigators from Member countries that have been under-represented in receiving research grants to join and contribute to the projects. Enhanced projects resulting from the accelerator program will be subject to the rigorous HFSP assessment and evaluation process prior to receiving support. This initiative is explicitly designed to help rebalance Member country benefits and acclimate more scientists to the HFSPO programs.

- HFSP will use Awardees Meetings as a central platform to engage all Awardees and Alumni in scientific discourse.

- Accelerate interdisciplinary research at the frontiers of knowledge by being open to collaborations with scientists from such diverse scientific disciplines as: environment, climate, behavior, and psychology. The Annual Awardees Meeting would provide a perfect environment to engage the scientific community at large in this respect. HFSPO will use the annual meeting as a platform to develop novel themes and concepts that demand joint efforts involving researchers from outside the core life sciences. The awardees' annual gathering provides an opportunity to enhance the multidisciplinary character of HFSPO's approach to frontier life science research.

- Develop opportunities for the world's most creative scientists, early career researchers, to share views, perspectives, and to benefit from the synergy of being together and brainstorming in candid, open discussions. HFSPO aims to create a limited number of frontier workshops that consider research and science policy aspects, but also remain open to tackle controversial topics, which is a fitting niche for HFSPO as a supporter of frontier research. Workshops will be conceived in consultation with the Council of Scientists and the community of HFSP awardees and alumni. They offer an opportunity for member countries to determine frontier moving themes that would merit interdisciplinary gatherings.

- Connect with like-minded organizations to organize and sponsor transdisciplinary discussions and presentations for those who share our curiosity-driven mindset. These may be international science summits, public lectures, or policy conversations related to frontier life science. HFSPO may consider setting up informal gatherings of scientists with breakthrough discoveries and those in the innovation space interested in tech transfer.

- Expand our communications and outreach so that HFSPO participates in important policy discussions and public dialogue that involve frontier life science research by crafting thought pieces for publication and setting up online conversations and discussions.

GOAL 3: BECOME A GLOBALLY INCLUSIVE ORGANIZATION

Welcome and engage a diverse array of peoples' ideas, perspectives, and research institutions across HFSPO and extend our shared values.

When HFSPO was established, Member countries agreed that international collaboration was essential for creative, thoughtful, brave experimentation in frontier life science research. Our core programs were designed to bring scientists into new environments so they could learn new ways of doing things and new ways of thinking. More than 30 years later, diversity, equity and inclusion, as guiding lights for growth in the 21st century, invite us to bring together diverse peoples, ideas, and perspectives so that our frontier enterprise has the full benefit of a wide range of talents and abilities. One could say, the architecture of HFSPO is undergoing necessary renovation because the times have changed. It is no longer sufficient for HFSPO to reflect simply the priorities of G7 nations.

A rebalancing is needed on multiple levels. First, since HFSPO's inception, Japan has been the single largest contributor year after year, providing currently 35% of HFSPO financial resources. HFSPO not only needs to diversify how it operates in terms of who benefits, it also needs to diversify and broaden how the costs of providing the program are delegated.

These changes not only reflect an evolution of our economics and structure, but also of our Shared Values. Many Member countries ramping up their frontier life science capabilities are on a good track to contribute to the HFSPO culture, but existing inequalities across the Membership must be addressed to fully integrate scientists from all Member countries. It is vital that all Members feel they have equal access to HFSPO core programs, engagement, and other opportunities for participation, because the last decade of operations has demonstrated that scientists from many non-G7 nations excel in HFSPO awards.

HFSPO needs to fully embrace diversity and inclusion to support the growth in frontier science that has occurred organically, provide necessary operational grounding for our core programs, and to honor our Shared Values of supporting international collaboration and respect within the HFSPO community. With this imperative comes the need to become more aware of the possibility of unconscious bias in our processes and become more inclusive of people and different views. This is critical for HFSPO as we seek to rebalance and strengthen our HFSPO community. For too long, many countries were disadvantaged

We will:

- Establish, articulate, and adopt a Diversity, Equity and Inclusion Policy position for HFSPO.
- Invite new Member countries, that adhere to our Shared Values, to join HFSPO to invigorate our core programs with new applications, energy, and commitment and widen our financial basis.
- HFSPO realizes there are issues in which top talent from some Member nations pursue fellowships in host countries, but then do not return to their home countries with that knowledge to infuse the local science enterprise, which is tantamount to a 'brain drain.' Often this happens with countries that are historically disadvantaged and/or isolated from participating in the global life science enterprise. HFSPO, in close consultation with its Members, will initiate discussions for suitable programs to address this imbalance in the next three to five years.
- In the entire assessment and selection process for awards, HFSPO will make concerted efforts to strengthen and support diverse perspectives and experience by including reviewers with diverse geographical and gender backgrounds without compromising scientific excellence and expertise, and bring awareness to reduce possible unconscious bias.
- Ensure HFSPO involves diverse peoples, perspectives, and access to resources. HFSPO will review its communications products, both print and online, to identify areas where the team can provide a better balance of diverse faces and voices to create a more inclusive expression of the organization and its people.

and unable to participate in the frontier life science enterprise, but with the massive shifts that the global economy has brought, and the worldwide demand for greater diversity and inclusion in all aspects of society, we are seeing old patterns transform. But these changes do require conscious thought, patience, and a willingness to get out of our comfort zones. HFSPO is committed to this transformation for our community.


Outlook

HFSPO is at a crossroads. A successful organization with more than 30 years of history, HFSPO is a fundamental player in driving many of the most significant breakthrough discoveries in the life sciences. Yet, the world has changed dramatically since we opened our doors. Change is occurring at all levels, economically, culturally, and politically, as the consequences of the Industrial Revolution are coming back in the form of environmental devastation.

Increasingly, geopolitical instabilities create new barriers for scientific collaboration of researchers from different countries, which increases HFSPO's value as an effective, international organization that awards the best in frontier life science research grants and fellowships. HFSPO's value proposition is a keystone for continuing the successful work of the program that enables research collaboration across divides. Going forward, the program remains committed to its core values of supporting excellence in basic frontier research in the life sciences, while supporting evolutionary growth. HFSPO values research that is investigator-driven, entails high-risk, high-reward approaches, and applies interdisciplinary, internationally collaborative methods that engage with a wide array of scientific communities, including scientists from the environmental and climate change research community, behavioral sciences, and psychology.

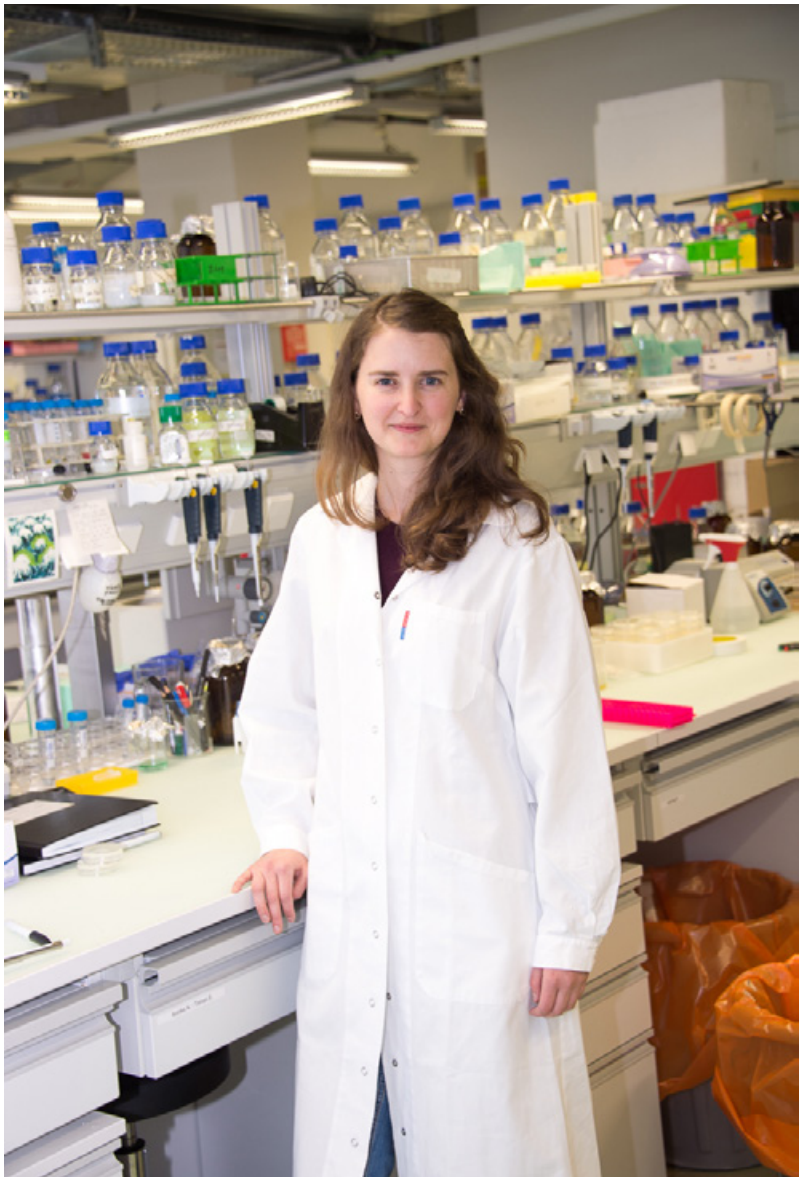
HFSPO has crafted its Strategic Plan 2024 -2032 that prioritizes its longstanding core programs in research grants and fellowships knowing that this overwhelming priority requires the commitment and support to increase and to improve engagement to make HFSPO a globally inclusive organization.

Thus, this plan, constructed around one primary and two supporting goals, operates as a unified intention to strengthen HFSPO's core programs and mission. HFSPO will invigorate these programs so they forge a future for HFSPO as a global leader in frontier life science and close the "frontier gap" in life science projects, and ensure more equitable benefits sharing among HFSPO Members and the entire HFSPO community. These aspirations can only be achieved by becoming a globally inclusive organization. The reason for this is that HFSPO as an organization has entered a period when the frontiers that we have played such a huge role in opening are themselves rapidly expanding. In order to remain a global leader and a significant player, we must pursue a serious and committed path that involves and engages the full range of scientific talent and excellence in the frontier life science enterprise.

The HFSPO strategic plan proposes careful and strategic evolution and growth over a period of nine years, from 2024 to 2032. For the purposes of planning and implementation, this strategy spans three triennia, three budget cycles, with a possibility to look back, reflect, evaluate, and adjust as needed at the beginning of each new triennium.

Our new strategy, and its underlying specific Triennial Program Activity Plans, are also fully "scalable," allowing us to match the size of our programs and activities to the real available budgets on an annual basis. By prioritizing our Research Grants and Fellowships and forging opportunities for growth through engagement and cultural revitalization, HFSPO is convinced this is the best strategy to position us and the frontier life science we support for a meaningful and vital future.

> "No one becomes a pioneer by staying at home. To foster new ideas and discoveries, one must be willing to embrace discomfort. Engaging with individuals who possess diverse perspectives is among the most effective ways to promote personal and intellectual growth."
>
> Shigekazu Nagata



Acknowledgements and Photo Credits

ACKNOWLEDGEMENTS

Developing the HFSPO Strategic Plan 2024-2032 represents our first formal strategic planning effort and as such has involved input, contributions, and recommendations a wide array of people performing diverse roles in our community. For 1.5 years, we drafted white papers on our program's performance and engaged in round-table discussions to establish our goals and vision for the next nine years. Over months, HFSPO executives engaged with scientific leaders in our Member countries and welcomed feedback and garnered support for our strategy. They provided a valuable sounding board ultimately helping to strengthen our ideas and improve the strategy's vision and focus. HFSPO leaders in our Board of Trustees, Council of Science, scientists, stakeholders, and Secretariat reviewed multiple drafts and provided constructive insight, creativity, and dedicated much time and energy to making this the best document possible. We are grateful to everyone who has engaged in discussion, reviewed drafts, and provided detailed recommendations. We hope this strategy will provide an inspiring vision for the HFSPO community as a whole going forward.

PHOTO CREDITS

Page 1: Peter Franks, School of Life and Environmental Sciences, University of Sydney, Australia, studies the interaction between plants and climate with a special interest in how plants control photosynthesis and transpiration in response to environmental signals.

Page 5: In June 2023, HFSPO hosted "Fundamental Life Science Meets Climate, Environment and Sustainability," a High-Level Summit and International Scientific Symposium at the Académie des sciences in Paris. On the dais: Pavel Kabat, Secretary-General, HFSPO, Alain Fischer, President, Académie des sciences, and Shigekazu Nagata, President, HFSPO, listen to the opening remarks delivered by Sylvie Retailleau, French Minister of Higher Education and Research.
Photo credit: Xavier Schneider.

Page 7: Visiting HFSP stakeholders in Hyderabad, India. Left to right: K. Thangaraj, Director, Centre for DNA Fingerprinting and Diagnostics; Guntram Bauer, HFSPO Director of Science Policy and Communications; Rashna Bhandari, Scientist, Centre for DNA Fingerprinting and Diagnostics; Pavel Kabat, HFSPO Secretary-General; G. Taru Sharma, Director, National Institute of Animal Biotechnology; Vinay K. Nandicoori, Director, Centre for Cellular and Molecular Biology; D. Srinivasa Reddy, Director, Indian Institute of Chemical Technology; Sanket Goel, Dean, Research and Innovation, BITS Pilani Hyderabad campus.

Page 10: Vickery Arcus, University of Waikato and an HFSPO Trustee, was awarded a James Cook Research Fellowship in Biological Sciences for his research entitled: 'Macromolecular Rate Theory: The temperature dependence of biological rates from enzymes to ecosystems.

Page 13: Sunrise over wheat: Pixabay

Page 14: At the Centre for DNA Fingerprinting and Diagnostics in Hyderabad, India, a welcome mandala of thousands of flower petals greeted HFSPO officials on their arrival. Photo credit: Guntram Bauer.

Page 15: The Republic of Korea hosted the 12th Awardees Meeting in Daegu, Korea. Left to right: Park Jin-Seon, Director of Global Cooperation Division, Ministry of Education, Science and Technology, Republic of KoreaHi; Kil-Choo Moon, President of Korea Institute of Science and Technology; Akito Arima, HFSPO President; Toru Nakahara, HFSPO Deputy Secretary-General; Nobutaka Hirokawa, HFSPO President; Ernst-Ludwig Winnacker, HFSPO Secretary-General; Yoo-Hun Suh, HFSPO Trustee; Rae Silver, HFSPO Council; Gina Turrigiano, HFSP Nakasone Award winner; Young-Joon Kim, Chair, HFSPO Council.

Page 17: Ocean scene: Aleksandar Pasaric

Page 20: Svante Pääbo won the HFSPO Nakasone Prize in 2018 and Nobel Prize in Physiology or Medicine in 2022 for his discovery of the extent to which hybridization with Neanderthals and Denisovans shaped the evolution of modern humans, and his development of techniques for sequencing DNA from fossils.

Page 21: Jackie Goordial, School of Environmental Sciences, University of Guelph, Canada and HFSP Awardee, conducts research in a snowy Arctic landscape. Photo credit: Ianina Altshuler.

Page 22: Scientists attend research presentations at an HFSP Awardees Meeting.

Page 23: Attendees gather for the High-Level Summit and International Scientific Symposium in Paris in 2023. Photo credit: Christophe Peus.

Page 25: Ministers, scientists, and government officials focused on climate science, sustainability, and related interdisciplinary issues came from around the world to participate in the 2023 High-Level Summit and International Scientific Symposium held at the Académie des sciences in Paris. Photo credit: Xavier Schneider.

Page 26: Mary Chibwe of the Rhodes University, South Africa, discusses her research regarding antibiotic-resistant *Campylobacter* in selected river systems of the Eastern Cape of South Africa during the 2023 HFSP Annual Awardees Meeting.

Page 27: Early career scientists learn more about an experiment during a poster session held during the 2016 HFSP Annual Awardees Meeting in Singapore.

Page 29: HFSPO Trustees and their Delegations, Triennial Conference of HFSPO Members in Paris, June 2023, Left to right: Theresa Good, USA, Vice President; Nancy Sung, USA; Simona Berardi, Switzerland; Tara Schwetz, USA; Puskar Sharma, India; Signe Ratso, European Commission; Hyong-Ha Kim, Korea; Michael Strong, Canada; Hee Joung Yun, Korea; Anne Kelso, Australia; Torsten Geissler, Germany; Mark Palmer, UK, Treasurer; Teck Seng Low, Singapore; Alejandro Adem, Canada; Pavel Kabat, HFSPO Secretary-General; Marco Borra, Italy; Jacques Demotes, France, Vice President; Shigekazu Nagata, HFSPO President and Chair; Kristin Danielsen, Norway; Iris Eisenberg, Israel; Melanie Welham, UK; Henriette van Eijl, European Commission; Kian Teik Beh, Singapore; Ingrid Ohlert, Germany; Troels Petersen, New Zealand; Liesl Zuhlke, South Africa; Yoshinao Mishima, Japan; Eugene Lottering, South Africa. Photo credit: Xavier Schneider.

Page 30: During the 2023 HFSP Annual Awardees Meeting in Cape Town, many African scientists presented research during the poster session.

Page 31: Annika Nichols, of Australia, was awarded an HFSP Long-Term Fellowship in 2019 to join the host laboratory of Biozentrum, University of Basel, Switzerland, to study the neuronal and genetic regulation of sleep and arousal in zebrafish.

Page 31: Robert Parton, Group Leader and HFSP Awardee, and Harriet Lo, Research Fellow, both of the Institute for Molecular Bioscience, University of Queensland, Australia, are studying how cellular organelles help defend against pathogens.

Page 33: Apurva Sarin, Director of Institute for Stem Cell Science and Regenerative Medicine, India, and HFSPO Trustee, and Pavel Kabat, HFSPO Secretary-General enter the Indian Institute of Science Education and Research, Pune.

Page 35: In 2022, HFSPO launched the Scientists for Scientists Initiative (S4S) to help Ukrainian researchers affected by the war to continue their research in host institutions around the world. Iryna Peretiazhko, Taras Shevchenko National University of Kyiv, is working in the host laboratory of Julien Bergeron, Senior Lecturer, Randall Centre for Cell & Molecular Biophysics, King's College London, in the United Kingdom. Their project: bacterial biofilms as a multicellular organism – from molecules to populations.

Page 37: Forest canopy: Pexels, Samuel Jean Butler.

MEMBERS OF HFSPO

HFSPO is grateful for the support of its Management Supporting Parties and other organizations (*):

Australia
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Canada
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