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SCIENCE DIPLOMACY:
AN OPPORTUNITY
FOR GENEVA

by Sarah Sermondadz

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science journalist

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FOREWORD



The Fondation pour Genève works to promote Geneva's influence, attractiveness, and openness to the world, in particular by supporting the action of the Federal, Cantonal and Municipal authorities. This implies the development and support of multilateral institutions that contribute to a better global governance.

If many labor, health, trade, climate or intellectual property global matters, peace negotiations and humanitarian affairs are today addressed in Geneva, we owe it to deeply anchored institutions that chose to settle here, sometimes more than a century ago.

The role of our Foundation is also to clear new paths. This study takes stock of recent initiatives in the field of science diplomacy to provide a better understanding of this discipline, that is gaining significant traction globally.

With the establishment of GESDA, supported by our Federal and Cantonal authorities and the support of our Foundation, Switzerland was right. It anticipated, before others, that in upcoming years, certain scientific advances will be questioned and raise new global governance challenges.

Today, these developments are on the verge of turning the world's organization upside down and of reshuffling the cards. Very soon, we will need to rethink international relations, as it has already been the case in Geneva, leading to the creation of CERN 70 years ago, thus positioning our region as the global hub for research in particle physics.

Our Foundation entrusted this study to Sarah Sermondadaz, a renowned science journalist and engineer who brilliantly carried it out. The aim was not only to map the political and academic interactions that are taking place in Geneva around scientific challenges, but beyond, to explore ways for Geneva to renew its international network. I would like to thank her, as this work is, to our knowledge, the most comprehensive study ever written on the subject.

Marc Pictet
President of the
Fondation pour Genève



EXECUTIVE SUMMARY

Like Janus, science and technology have two faces: sometimes bountiful, promises of extended life expectancy or answers to the great mysteries of the universe, sometimes troubling, when they escape control, sometimes even from States and the international community. They now lead the progress of the world, unfolding much faster than international law and regulations, while diplomacy is tied to the ability of its representatives to build a patient consensus.

This is one of the reasons why Switzerland has made science diplomacy an explicit focus of its foreign policy. This is also what led the Federal Council and the Geneva Council of State to support the Geneva Science and Diplomacy Anticipator (GESDA), a Swiss foundation based in Geneva offering a new perspective: "anticipatory" science diplomacy.

Science diplomacy dates back to the invention of diplomacy itself, but it only became a separate concept during the Cold War, under the threat of nuclear warfare. This detour through history is useful to understand the singularity and ambition of the foreign policy tool that GESDA represents: both an instrument of anticipation, a diplomatic forum as an invitation to frame the development of science and technology, and an incubator of solutions for the benefit of the common good built as a public-private partnerships.

This is an important project for Switzerland, for Geneva and especially for International Geneva. Yet, the deployment of these activities takes time. The Open Quantum Institute (OQI), announced at the end of 2022, will be a concrete embodiment of GESDA's methodology.

After a description of science diplomacy, this report focuses on describing GESDA's vision and activities, complemented by a forward-looking section on potential and outstanding issues.

It concludes with some recommendations, developed at the end of the report:

For the authorities:

- to communicate more on the complementarity of the supported initiatives related to GESDA.

For GESDA itself:

- to adapt its communication and build different narratives adapted to the diversity of audiences and projects, more focused on concrete use cases,
- to justify the very broad spectrum of subjects covered by scientific anticipation, for example by communicating more about the possible solutions identified, even when they are only at an embryonic stage,
- to strengthen its presence in Geneva public space,
- and to develop bridges with other innovation ecosystems in Switzerland, particularly in German-speaking Switzerland.

1 SCIENCE DIPLOMACY: DEFINITIONS, BACKGROUND AND OPPORTUNITIES FOR SWITZERLAND AND FOR GENEVA

1.1 What is science diplomacy?

1.1.1 Introduction - Science diplomacy, a fast-growing discipline bridging two worlds

Science diplomacy has long historical roots: it has existed at least since antiquity (Egypt, Mesopotamia, Greece), when science and technology played a key role in trade and exchanges between the civilizations of the Mediterranean area. It can still be found during the establishment of the Silk Road between Europe and Asia, or more recently, behind the Treaty on the Non-Proliferation of nuclear weapons in 1968.

Over the past 20 years, the field has gained in popularity in diplomatic circles and foreign ministries. ministries of foreign affairs, but is still little known to the general public, for whom it evokes, at best, a combination of the two fields put together: diplomacy on the one hand, science on the other.

- Science diplomacy is first and foremost diplomacy. It is a matter of international relations, mobilizing alternating dialogue, negotiation, and representation issues within the international community. It is also a lever through which certain States will seek to exert influence – or, on the contrary, free themselves from foreign influence, all this in a multilateral context that is currently subject to many changes.
- “Scientific” must be understood in a broad sense, intersecting science, technology, and innovation (STI). However, the world of scientific research has its own complex ecosystem for the production and evaluation of knowledge, straddling the public (universities, national research centers) and private (R&D, particularly in the pharmaceutical and energy sectors). It is also intermediated by the scientific publishing sector, which allows researchers to publish their results and participate in the global scientific conversation. It is also marked by an unprecedented acceleration in the volume of knowledge produced.

In practical terms, science diplomacy can take very different forms, such as the creation of CERN in 1954, the early sharing of Sars-Cov-2 genomes by the international community at the beginning of the Covid-19 pandemic, the fight against the hole in the ozone layer, the constitution of the Intercontinental Panel on Climate Change (IPCC), the succession of Conferences of the Parties (COP) on climate change, or even attempts to stem the “brain drain”. These examples, and a few others, are detailed below.

However, the worlds of science and diplomacy are so different that they can seem distant or even contradictory. They are influenced by interests, codes, value systems and interplay that do not always overlap. These are two worlds that do not always speak the same language. This is probably why there is no single vision of science diplomacy. Definitions vary depending on whether one is addressing diplomatic actors or academics studying the issue from a humanities perspective (see box 1 below).

Some approximate definitions of science diplomacy

■ In 2009, Nina Fedoroff, science and technology advisor to the Secretary of State and Administrator of the U.S. Agency for International Development (USAID), defined it as “the use of scientific collaborations among nations to solve common problems facing humanity in the twenty-first century and to build constructive international partnerships.”

Vaughan Turekian, director of the Center for Science Diplomacy created in 2009 by the American Association for the Advancement of Science (AAAS) sees there “The use and application of scientific cooperation to build bridges and improve relations between countries.”

Pierre-Bruno Ruffini, professor of economics at the University of Le Havre (France), finally, believes

that it refers to all the practices that link the actions of researchers and those of diplomats, and specifies: “These practices can be directly linked to the interests of governments: this is the case when diplomats promote cooperation between scientists from different countries, while conversely international scientific relations facilitate the exercise of the diplomacy or play a pioneering role for it, and finally when scientific relations and expertise help governments and their diplomats to prepare and conduct international negotiations.”¹

➤ The numbers refer to bibliographic references listed at the end of the document under the “References” section.

We then arrive at a composite drawing: science diplomacy is a set of practices at the interface of the scientific and diplomatic communities. But an interface requires a common language to understand the representations and issues of the diplomatic world if one is a scientist, or of the scientific world if one is a diplomat.

Another peculiarity of science diplomacy: it can advance either in the open or behind the scenes, depending on the interests of the States. As Professor Luk van Langenhove of the Université libre de Bruxelles¹ writes:

“Science diplomacy is a label used [...] to designate certain [...] actions which involve the commitment of The scientific communities [...] in transnational interactions.” A label that we will choose to apply... or not. Explicitly talking about science diplomacy is therefore a strategic choice, for example to draw attention to practices, strengthen the legitimacy of the actors involved, or to dispel – or strengthen – a *soft power context*¹.

1.1.2 A brief history of science diplomacy

Timeline (not exhaustive)

- End of World War II (1945)
- Cold War (1947–1991)
- Launch of CERN (1954)
- Signing of the Antarctic Treaty (1959)
- Montreal Protocol (1987)
- Launch of the International Space Station (ISS) (1998)
- Kyoto Protocol (2005)
- Start of construction of the ITER experimental fusion reactor (2007)
- Paris Agreement (2015)
- Inauguration of the SESAME particle accelerator (2017)
- Launch of the Red Sea Transnational Research Centre (2019)
- Beginning of the Covid-19 pandemic (2020)
- Beginning of the war in Ukraine (2022)

Details of the timeline

■ 1954: Launch of CERN



Credit: Torbjorn Toby Jorgensen, via Wikimedia Commons

Context. L'Organisation européenne pour la recherche nucléaire (ou CERN) est souvent citée comme exemple de réussite en matière de diplomatie scientifique.

The European Organization for Nuclear Research (CERN) is often cited as a success story in science diplomacy. At the end of the Second World War, Europe had to rebuild itself, both politically and in terms of scientific research. But the atom, after Hiroshima and Nagasaki, had a bad reputation. To continue conducting research on the nucleus (today, our understanding of matter goes far beyond the nucleus, and we speak more readily of particle physics), it was necessary that it be part of a different narrative than that of war: it is therefore around the idea of "science for peace" – based on international scientific cooperation – that CERN was built.

It was necessary to convince diplomats to involve their states, which required the intervention of several renowned scientists – as well as the consent of Oppenheimer in the United States, who had led the Manhattan Project – to convince the European Council to create a European nuclear research laboratory⁴⁹. The decision was taken in 1951, at an intergovernmental meeting of UNESCO. This was the birth certificate of CERN, officially created in 1954⁵⁰. In this sense, the foundation of CERN is the culmination of a long process of science diplomacy.

The location of the CERN in Geneva was selected by the CERN Provisional Council in 1952 and accepted by the people of Geneva in a referendum the following year⁴⁹. The central geographical location, Swiss neutrality during the war and the fact that Geneva was already home to a large number of international institutions played a crucial role.

Successes. Major scientific results were obtained as successive particle accelerators and all the infrastructure surrounding them were built: first the proton synchro-cyclotron in 1957, then the proton super-synchrotron in 1971, which was finally reunited with the first in 1976. In 1989, the construction of the Large Electron Positron Collider (27 km in circumference) was completed, then finally the Large Hadron Collider (LHC) – the current accelerator – which replaced the LEP in 2008, after more than 10 years of work.

It is thanks to the LHC that a new elementary particle is identified in 2012: the famous Higgs boson, which would earn a Nobel Prize in physics in 2013 to physicists François Englert and Peter Higgs who had postulated its existence in the 1960s. The LHC is currently undergoing a multi-year renovation programme to increase its capacity. At the end of this project, the LHC will be able to produce more particle collisions and benefit from better sensitivity of the measuring instruments, which should increase the chances of discovering new particles.

CERN's discoveries do not stop at fundamental research: it was also at CERN that the World Wide Web was born in 1989, among others. Scientific work at CERN has also indirectly led to the development of innovations in the fields of oncology, archaeology, bioimaging and aerospace.⁵¹

■ 1998: Launch of the International Space Station (ISS)



Credit: NASA/Roscosmos, Public domain, via Wikimedia Commons

This is another emblematic example of scientific collaborations that have long been maintained despite sometimes tense diplomatic relations between the different countries to which the crew members belong. The beginnings of the station date back to the end of life of the Russian space station Mir. In 1992, the United States and Russia signed a cooperation agreement allowing American astronauts to stay in the Russian station (finally deorbited and destroyed in 2001). The bases of this cooperation were taken up again in 1998, planning the post-Mir period. Sixteen nations are taking part: the United States, eleven European states, Canada, Japan, Brazil and Russia. This is a strong decision, after the fall of the USSR and the space race with the United States, which is anchored around the idea of exploration, occupation, and peaceful use of space. For many diplomatic observers, the ISS has long been a model of science diplomacy⁵².

The station is divided into two segments: a Russian segment consisting of six pressurized modules operated by the Russian space agency (Roscosmos), and an "American" segment, operated by NASA, but also the European Space Agency (ESA), the Canadian Space Agency (CSA) and the Japan Aerospace Operations Agency (JAXA). The division is also operational: two main ground control centers are responsible for overseeing each segment, one in Houston, and the other north of Moscow⁵³.

In 2022, geopolitical tensions due to the war in Ukraine led Russia to announce, in July, its withdrawal from the ISS in 2024⁵⁴.

■ 2007: Start of construction of the ITER experimental fusion reactor



Credit: Oak Ridge National Laboratory, via Wikimedia Commons

It is one of the largest contemporary scientific projects. The International Thermonuclear Experimental Reactor (ITER), currently under construction at Cadarache in southern France, will be the largest experimental fusion reactor in the world. It must provide proof of concept that nuclear fusion, which reproduces reactions found in nature only in the heart of stars, can be used as a large-scale energy source to produce electricity in a carbon-free way. It must produce 500 MW of heat over periods of several hundred seconds.

Its construction began in the early 2000s, but the first preparatory design work dates back to the late 1980s. They rely on tokamak technology, originally invented in Russia in the 1950s during the Soviet era. The assembly of the various elements of the machine that will weigh the trifle of 23,000 tons once completed – 3.5 times the weight of the Eiffel Tower – is underway⁵⁵. Obtaining the first plasma of the reactor, initially scheduled for 2025, has been postponed to 2030⁵⁶.

It was initially Mikhail Gorbachev who gave the impetus for the project. The latter first convinced François Mitterrand, then Ronald Reagan in 1985 to collaborate on an international program that would build the next generation of tokamaks. In the end, 35 countries will be associated with the project: the European Atomic Energy Community (i.e. EU countries as well as Switzerland and the United Kingdom), as well as India, Japan, China, Russia, South Korea and the United States.

ITER's scientific successes are yet to come. Commentators have already pointed to the risk of budgetary drift and the delay in the project. Since 2007, the project's budget has already quadrupled⁵⁷ – and could end up around €40 billion. ITER has already been described as one of the most ambitious – and costly – scientific collaborations in history.

The sequel. ITER must prove the technological feasibility of nuclear fusion for several minutes at a time, without electricity production. To go further, once the proof of concept has been obtained, the European research consortium EUROfusion (in which Switzerland also participates) intends to build a demonstrator capable of producing electricity. Called DEMO, its construction is planned for 2040.⁵⁸

■ 2017: Inauguration of the SESAME particle accelerator

The project. SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) is a particle accelerator near Amman, Jordan, whose model was deeply inspired by CERN. The accelerator's first electron beam was emitted in 2003, for the center to be officially commissioned in 2017⁶⁰. The diplomatic ambition is clearly spelled out: to use science to bring enemy countries closer together⁶¹. From a scientific point of view, the instrument – there are currently about sixty synchrotrons in the world – can be used as a kind of "microscope" to probe matter in multiple fields: materials science, archaeology, chemistry, biology, pharmaceutical industry...

The context. The history of SESAME began at CERN in 1993. Physicists Sergio Fubini and Eliezer Rabinovici, just after the Oslo Accords between Israel and Palestine, laid the groundwork for an unprecedented project: to build the first particle accelerator in the Middle East. The beginnings are difficult: at first, no one wanted to believe in the project. A first symposium took place in 1995 – under Bedouin tents in the Sinai desert – and brought together personalities from Jordan, Morocco, Egypt, and Palestine, as well as a hundred scientists including several Nobel Prize⁶². The project was officially launched in 1999 by Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, Palestine, and Turkey. It was placed under the auspices of UNESCO in 2002.

Challenges. To limit the costs, it was quickly decided to reuse the X-ray source of the German synchrotron BESSY 1 then being dismantled. But the stakes are high: "In principle, we did not want a 'cheap' machine," recalled Eliezer Rabinovici⁶³ in 2013. "The main drawback of the BESSY-based proposal was that it was impossible for an 'old' rebuilt and dismantled machine to attract top-notch scientists," the physicist wrote in early 2023.⁶² The strained academic relations between some of the members were also problematic. These difficulties have been overcome thanks to UNESCO's intervention.

The second difficulty lay in financing: the initial budget is estimated at 110 million euros and has long contained large holes⁶³. The individual founding states each pledged €5 million initially – plus €3 million, followed by an additional €5 million from the EU⁶². The financial challenges are not yet fully resolved, but for now, the accelerator manages to operate on a tight budget.

■ 2019: Launch of the Red Sea Transnational Research Centre

This research center, created with the support of Switzerland in 2019, is based on research published in 2017 by EPFL's Laboratory of Biological Geochemistry (LGB). It aims to study corals in the Gulf of Aqaba and the Red Sea, which can withstand rising water temperatures like nowhere else in the world⁶⁴. A better understanding of these corals could be used to repopulate reefs in other parts of the world that are more affected by the effects of global warming.

This project is clearly part of science diplomacy, Federal Councilor Ignazio Cassis commented⁶⁵. Alexandre Fasel, ambassador, FDFA Special Representative for Science Diplomacy, explained the challenge in 2021: "The ten states bordering the Red Sea, which do not always have excellent diplomatic relations, find a common interest in this scientific project, which creates the conditions for countries that normally do not like to cooperate to work together and build mutual trust. This creates a space to discuss other issues of a less scientific and more diplomatic nature⁶⁶.

The project experienced a setback in 2021, when the Swiss sailboat *Fleur de passion*, which was to host a scientific expedition to study corals under the aegis of this new research center, ran ashore on corals. And at the same time, caused some diplomatic turmoil, linked to tensions between some Arab countries bordering the Red Sea and Israel⁶⁷.

Some additional examples

■ 1987: Montreal Protocol

The fight against the hole in the ozone layer – now well on its way to being absorbed over the next 40 years – is a success of science diplomacy. Following the signing of the Montreal Protocol in 1987, States agreed to limit the use of CFC-based gases. Since then, the situation has improved considerably, but the ozone layer is not out of the woods. This example is not only a victory for science, but also for traditional diplomacy, which has had to deal with representatives of industry who have long done everything to preserve the status quo, which is reminiscent of the current blockages on the climate crisis⁶⁸.

■ 1959: Antarctic Treaty

As in space on board the ISS, States have mobilized the instruments of scientific diplomacy to be able to conduct research at the edge of the world, the Arctic and Antarctica. But geopolitical interests in the polar regions can be divergent: resources, maritime access routes, while they are extremely valuable land for scientific research. In the Arctic, the unfavorable geopolitical context related to the war in Ukraine has already delayed several scientific expeditions in 2022⁶⁹. In Antarctica, land has a special status, set by the Antarctic Treaty since 1959: military activities are prohibited as well as the exploitation of mineral resources except those carried out for scientific purposes. The signatories give priority to scientific research activities.

■ 2020: Covid-19 pandemic

It mobilized serious scientific diplomacy efforts, first to promote the exchange of the first viral genomes internationally, then to develop vaccines quickly. In this regard, you can also consult the previous study of the Fondation pour Genève dedicated to the response of International Geneva to the Covid-19 pandemic.⁷⁰



1.1.3 From theory to practice, the definition of a booming field

The plurality of definitions for science diplomacy does not mean that there is no common ground. In 2010, the British Royal Society and the AAAS delivered the first formal definition of science diplomacy², through a three-pronged classification:

- Science for diplomacy, the use of science to improve international relations, usually from the perspective of international scientific cooperation.

For example: This dimension is found when international scientific collaborations remain possible between researchers from countries in conflict. At CERN, for example, American and Soviet researchers continued to work together during the Cold War. In the Middle East, the SESAME particle accelerator uses the same logic by allowing researchers from countries in diplomatic cold to work on a single infrastructure.

- Diplomacy for science, the use of the diplomatic apparatus to support large-scale scientific projects.

For example: This dimension is found in research projects so pharaonic that they cannot be financed by a single State, such as the large particle accelerator (LHC) at CERN or the experimental fusion reactor ITER,

as well as the *Square Kilometer Array Observatory* (SKAO) of advanced radio astronomy initiated by South Africa, the United Kingdom and Australia, of which Switzerland is a full member.

- Finally, science in diplomacy when scientific advice guides the foreign policy of States.

For example: The Intergovernmental Panel on Climate Change (IPCC) was specifically established by the World Meteorological Organization (WMO) in 1988 to provide decision-makers with a clear scientific vision of climate change, its evolution scenarios, and its possible environmental and socio-economic consequences. Its reports provide, every five to eight years, an up-to-date state of play of scientific knowledge on climate.

This classification is a good starting point for theoretical discussions. But in practice, these three dimensions are often intertwined. In 2018, several scientific advisors to governments illustrated this state of affairs, based on the example of the climate crisis³:

"International action on the problem of climate change mobilizes the three dimensions of this classification.

- *Diplomacy is necessary to constitute and maintain the IPCC (diplomacy for science),*
- *international scientific cooperation is necessary to advance our understanding of the global climate system and facilitate international agreements (such as the Paris Agreement), (science for diplomacy),*
- *Scientific monitoring is useful to monitor our progress vis-à-vis these international agreements (science in diplomacy)"*

For the inaugural session of GESDA's Science Diplomacy Week in May 2022⁴, Peter Gluckman, President of the International Science Council, recalled: *"International scientific cooperation often serves to achieve scientific objectives"*. With science diplomacy, on the contrary, *"it's about using science to achieve diplomatic goals."*

It is therefore necessary to place oneself on the side of the actors and their practices to broaden the definitions. If we look at States or intergovernmental bodies, the actions of science diplomacy fall into three categories³.

- Those that relate to the national needs of a country (influence, security, economic development, scientific and technical means, etc.). They may emanate from official actors or non-governmental actors (so-called "track two diplomacy", or parallel diplomacy),
- those that support transnational interests (access to resources, standards and common services, crisis management, social acceptance of science and technology, *big science*, etc.),
- and finally, those that aim to meet global challenges – such as the 17 Sustainable Development Goals (SDGs) of the United Nations, or ungoverned areas (Antarctica, space, part of the internet).

1.1.4 Towards a science diplomacy "2.0"?

The contemporary world is marked by a number of crises (climate crisis, war in Ukraine, consequences of the Covid-19 pandemic...), including the crisis of multilateralism, which has been constantly changing since the Second World War.

Several significant phases can be distinguished:

- first, a sustainable strategic multilateralism, with major strategic treaties such as the Antarctic Treaty in 1959, the Treaty on the Non-Proliferation of nuclear weapons in 1968, or the Chemical Weapons Convention in 1993,
- short term Third-Worldist multilateralism, which has resulted in the failure of small and medium-sized powers to take full advantage of the multilateral system,
- trade multilateralism – mainly governed by the WTO – which eventually breaks down,
- and declaratory multilateralism on humanitarian and environmental law ⁵.

In these last two areas of multilateralism, it can be noted that the postures of States are often declaratory (evidence, for example, by the non-binding commitments of the Paris Agreement), and that it is NGOs that are the most active promoters of international settlements.

Science diplomacy is articulated in this complex environment, so it is necessarily located in time and space according to foreign policy issues. At the end of the Second World War, it was first done, for example, through CERN, a work of "science for peace" ⁶.

The term "science diplomacy" dates back in particular to an American initiative to restore the reputation of the United States after the negative consequences on the country's reputation in the wake of the 2003 Iraq war ¹. The idea was then to rely on the image of neutrality and impartiality that is attributed, rightly or wrongly, to scientists.

Science diplomacy therefore lives with the challenges of its time. Academics have noted that the Global South is still underrepresented in science diplomacy narratives. ⁷ But at the same time, the acceleration of scientific, technical and technological progress represents an unprecedented opportunity to develop "science diplomacy 2.0", based on the exploitation of data and metadata from multiple scientific disciplines. ⁸ In this renewal, scientists and organizations can take on a "critical role in addressing global challenges such as climate change or pandemics," Gluckman said. ⁹ "These actors are essential both for official diplomacy and in the informal processes of non-governmental organizations", he added.

1.1.5 The Swiss approach

At the same time, the United States is no longer the only one to explicitly call on science diplomacy: Europe is not to be outdone. In 2018, at a meeting of a group of experts under the aegis of the European project for science diplomacy S4D4C to think "the EU's science diplomacy beyond 2020", the Madrid Declaration on Science Diplomacy was born ¹⁰. It was based on a twofold observation:

- science diplomacy remains insufficiently exploited at all levels of governance, in particular at supranational levels,
- More explicit strategies would make it possible to fully exploit its potential.

This declaration was signed by more than 165 experts, mainly based in Europe. It has also attracted interest in Switzerland, particularly from Ignazio Cassis, Federal Councilor in charge of the Federal Department of Foreign Affairs (FDFA) since 2017, steering the Swiss foreign policy into a new direction, more focused on science diplomacy. "It's (...) an opportunity for Switzerland to profiling the excellence of its science park for global dialogue," Federal Councilor 11 wrote in 2019, "Our country is not at its trial run

in this area, even if the word is new." During the same speech, he mentioned the Red Sea Transnational Research Center created the same year, with the support of Switzerland and the participation of EPFL.

The Swiss Foundation GESDA, established in 2019 and discussed in detail in the following sections, is part of this renewed interest. One of its peculiarities is that it formalizes the role of science and technology for foreign policy by adding to the three definitions of the AAAS and the Royal Society a fourth definition, that of anticipatory science diplomacy ¹². Ambassador Alexandre Fasel, FDFA Special Representative for Science Diplomacy, explains that it can also be seen as "a variation of science in diplomacy".

Switzerland's interest in science diplomacy is not new: the appointment of Switzerland's very first scientific advisor, Urs Hochstrasser, dates back to 1958. The latter's mission was to report to Bern on the progress made by the United States on nuclear technology ¹³. Today, science diplomacy is one of the axes identified, along with digital technology, in the foreign policy strategy implemented for the period 2020-2023 by Federal Councilor Ignazio Cassis ¹⁴. In its digital strategy, Swiss foreign policy also intends to better position international Geneva as a global centre for debates on digitalisation and new technologies.

In 2021, for the first time, the FDFA appointed an ad hoc ambassador for scientific diplomacy. Alexandre Fasel, who previously served as Head of the Permanent Mission of Switzerland to the United Nations Office between 2012 and 2016, embodies this role. It is complementary to that of Benedikt Wechsler, appointed digital ambassador, also in 2021.

1.2 How science diplomacy is embodied in Switzerland and Geneva

1.2.1 Who are the professionals of science diplomacy in the Swiss and Geneva ecosystem?

We have seen it in the above: there is, on the one hand, official diplomacy which is played first at the head of States (*track one diplomacy*), and on the other hand, a parallel diplomacy (*track two diplomacy*) carried out by non-governmental actors – and potentially official representatives of States – which is called upon to play a growing role.

There is a wide range of actors in science diplomacy¹⁵:

- government actors, foreign policy actors (FDFA) or science policy actors (State Secretariat for Education, Research and Innovation).
- intergovernmental actors, i.e. international organizations directly involved in global governance. Many have their European or global headquarters in Geneva, such as the UN, WHO, ILO, WIPO, ITU, WMO, UNHCR, WTO or ISO and many others.
- academic actors, in particular: universities, research centres, which depend on SERI, but also research funding bodies, academies and other scientific professional networks.
- private sector actors, who participate in major research infrastructures, either through industrial consortia participating in major projects (ITER, SESAME, space, etc.), or through public-private partnerships such as the CERN Open Lab (see Box 6) or GESDA. A significant part of R&D is also carried out by private actors.
- economic and civil society actors, NGOs, foundations, associations, and in some cases individuals themselves.

It is also necessary to examine the networks in which these actors are embedded, which can be articulated at the regional, national or global level¹⁵. This may include:

- national innovation networks based abroad. In this respect, the Swissnex network is often seen as a model (see Box 2),
- diplomatic circles,
- or scientific networks. Networks active in the field of science diplomacy include:
 - the International Science Council (ISC) is an NGO representing the international scientific community. It brings together more than 220 organizations, including international scientific unions and associations of natural and social sciences, humanities, and national and regional scientific organizations such as academies and research councils. It aims to catalyze scientific expertise, advice, and influence on issues of importance to science and society.
- It should be noted that there are also worldwide networks of scientific advisers inserted into the official diploma of States, such as:
 - the Foreign Ministries Science and Technology Advice Network (FMSTAN), which brings together scientific advisers working within foreign ministries, and
 - the International Network for Government Science Advice (INGSA), a collaborative platform to strengthen the science-policy interface at global, national and transnational levels – of which FMSTAN is under the umbrella.

A list of the main actors of International Geneva involved in scientific diplomacy activities can be found in the appendix.

swissnex, a Swiss success story



■ More and more states have set up networks of science and technology "ambassadors" abroad, such as the Office of Denmark's Tech Ambassador, launched in 2017, which has a branch in Palo Alto (United States), and Beijing. But Switzerland was a pioneer in creating the swissnex network more than 20 years ago. The first site opened in October 2000 in Boston. Today, the network has five sites – Boston, San Francisco, Rio de Janeiro, Bangalore, Shanghai and from 2023 Osaka – and can count on around twenty scientific advisors worldwide, based in Swiss ambassadors abroad.

"Swissnex is a global network, which penetrates all ecosystems related to scientific research, innovation and innovation."

Alexandre Fasel, ambassador and FDFA Special Representative for Science Diplomacy, sums up Alexandre Fasel. *"It is a way to show our know-how and attract scientists and innovators to Switzerland – and in particular to maintain contact with Swiss post-doctoral researchers abroad. It is a network that penetrates the global conversation that defies the categories between diplomacy, science and technology."*

SERI is responsible for the strategic and operational management of the network, in coordination with the FDFA. The year 2018 marked a turning point in its strategy, which has explicitly become a vehicle for science diplomacy, in its dimension "Science for diplomacy"¹⁶.

1.2.2 Geneva's place in Swiss diplomacy



Thanks to the presence on its soil of 39 international organisations, 750 NGOs and 250 diplomatic representations, Geneva plays a key diplomatic role for Switzerland. It is one of the "world cities" at the forefront of global governance, and can act as a link for its host state.

"International Geneva is a central element of our international standing," explains Alexandre Fasel. *"In multilateral diplomacy, in order to effectively promote their interests, countries must proceed from a certain positioning, which gives them audience and scope. This can be the economic power of a country, its geostrategic importance, its size, its demographics or sometimes even its potential for harm. And Switzerland's positioning is Geneva. Its status as host state of one of the most important centres of global governance allows Switzerland to "weigh heavier than its real weight" (Switzerland is punching above her weight, said Kofi Annan) in the concert of nations."*

For Swiss foreign policy, global governance based on law, social justice, development, and prosperity is fundamental, insofar as it serves Swiss interests, Alexandre Fasel continues. "Swiss foreign policy recognises the acute interdependence of states, with common concerns and challenges and solutions that can only be shared. If we compare the Charter of the United Nations and the Federal Constitution in the objectives they set for themselves, we see that they express the same values."



2 GESDA, OR WHEN DIPLOMACY MEETS SCIENTIFIC ANTICIPATION

2.1 Brief history of the creation of GESDA

The creation of GESDA was decided on 20 February 2019 by the Swiss and Geneva governments for an operational launch in January 2020. It is independent, not-for-profit, operating through public-private partnerships. In a few words, the Foundation aims, in favour of multilateralism, to leverage the International Geneva and Swiss ecosystems, to anticipate, accelerate and translate into concrete actions the use of emerging science-driven topics, so that everyone can quickly benefit from scientific advances.

Before detailing its vision, its organization and its activities, some elements of historical context.

2.1.1 2012-2013: Birth of the strategy to strengthen Switzerland's role as host state

Switzerland's host state policy was strengthened 15 years ago with the initiative to provide it with genuine legislation in this area. The reflection on the attractiveness of International Geneva was the logical follow-up. At the origin of the renewed reflection on Geneva's place in Swiss diplomacy, a founding event: the failure of Geneva in 2012, to become the headquarters of the Green Climate Fund, for the benefit of the South Korean city of Songdo¹⁷ – a new city, "smart city" built on a polder of more than 600 hectares. A failure in the first round, with only one vote in his favor.

Didier Burkhalter, head of the Department of Foreign Affairs at the time, sets up a task force to reflect on the future of International Geneva. The challenge: defining a sustainable strategy on the issue, with its own messages and funding, so that Geneva - in its diplomatic dimension - operates with predefined funding, rather than on a case-by-case basis according to needs.

In 2013, this working group, called Task Force International Geneva (TAFOGI), delivered to the Federal Council a first strategic report* on the challenges facing International Geneva, which became a message from the Federal Council, approved by the Federal Parliament, with its own budget.

2.1.2 2015-2018: The Geneva+ Working Group

In spring 2015, Didier Burkhalter asked for further reflection under the aegis of a new group, called Genève+ and which will become the core of what GESDA would become.

In 2018, Genève+ presents its final report proposing to Ignazio Cassis the creation of an independent foundation functioning as a *think tank* and a *do tank* based on scientific anticipation, aiming to respond to the accelerating pace of technological development, to overcome the "silos mindset" that often characterizes international organizations, and to conclude new partnerships, particularly between International Geneva and the academic world¹²:

In 2018, a first version of the project, under the name Geneva Plus, was rejected by the Federal Council¹⁸. In 2019, the creation of GESDA was finally approved by the Federal Council¹⁹. Its budget was initially

* Report signed by Fulvio Pelli (president), Patrick Aebischer (vice-president), Rolf Soiron, Michael Møller, François Longchamp, Sandrine Salerno, Janet Voûte, Jakob Kellenberger, Carlos Lopès, Frédérique Reeb-Landry, Linh Ramirez, Doris Schopper, Mirjana Spoljaric, Alexandre Fasel and Valentin Zellweger, with contributions from Stéphane Decoutère, Gérard Escher, Philippe Gillet and Samir Yeddes

approved only by a narrow majority from the Foreign Affairs Committee of the National Council before being finally approved by Plenum²⁰.

2.2 GESDA methodology: “Use the future to build the present”



In practice, GESDA promotes a form of scientific diplomacy that aims to incubate concrete solutions, on the model of the start-up world. Hence its slogan: “use the future to build the present”. GESDA Foundation, thus takes the form of a public-private partnership and defines itself as both a *think tank* and a *do tank*. In November 2019, the foundation developed its own method, called “Anticipatory Situation Room Process”²².

To identify and develop global solutions based on future scientific and technological breakthroughs, the method is divided into three stages and is based on the collaboration of four communities:

- the academic world,
- the diplomatic world,
- economic actors,
- and the citizens.

The three stages revolve around these communities:

1. Scientific anticipation (Academic Forum)

GESDA Academic Forum is a network of researchers in Switzerland and abroad, responsible for identifying the major scientific and technological trends that are “cooking in the labs” and that are likely to impact individuals, society and the planet, within the next 5, 10 and 25 years. This scouting exercise serves as the basis to the GESDA Science Breakthrough Radar[®] which will be further described.

2. Diplomatic Acceleration (Diplomatic Forum)

The results of the scientific anticipation phase are then shared through the Diplomatic Forum with GESDA other communities. The challenge is to accelerate the response to major global challenges: health, agriculture, poverty, education, environment, etc., based on the SDGs. The challenge is to translate the emerging trends from the GESDA Science Breakthrough Radar into a toolbox, a pipeline of pilot initiatives and demonstrators that can be implemented to address global challenges.

These possible solutions can take various forms depending on the topics addressed: new international organization, new international regulations, new research centers, organization of conferences in Geneva...

3. Translation into concrete actions (Impact Forum)

Inspired by the start-up environment, GESDA then intends to enable pilot initiatives to be deployed on a global scale, relying in particular on its Impact Forum. Its strategic and operational partners have a key role to play, as they must help mobilize the necessary funding for the implementation of solution ideas, in collaboration with the institutions of International Geneva. GESDA serves as a neutral, honest, and transparent intermediary (*honest broker model* detailed below in Box 5).

2.3 Organization and activities

2.3.1 Governance

GESDA is organized around a foundation board and four fora that represent its four communities of practice: scientific community (Academic Forum), diplomatic community (Diplomatic Forum), economic community (Impact Forum) and finally citizen community (Citizen Forum). Each Forum is chaired by one of the members of the Board. Their composition and activities are detailed below.

The idea of the Academic Forum, the Diplomatic Forum and an Impact Fund dates back to the Geneva+ working group. Since 2019, the foundation also features an executive team of about ten people. Forum members and scientists involved in the GESDA Science Breakthrough Radar[®] contribute on a volunteer basis.

2.3.2 Foundation Board of Directors

According to the statutes, the Board of Directors must comprise:

- At least one member representing the Confederation, appointed by the FDFA.
- At least one member representing the Republic and Canton of Geneva, appointed by its Council of State, who consults the City of Geneva and the stakeholders of his choice.
- The President and Vice-Chairman of the Foundation Board are appointed by mutual agreement of the founders. Their appointment is subject to a decision by the Federal Council.

As of February 2023, it had 11 members*.



* Peter Brabeck-Letmathe (Chair), Patrick Aebischer (Vice-Chair), Samantha Besson Micheline Calmy-Rey, Stéphane Decoutère, Sir Jeremy Farrar, Fabiola Gianotti, Michael Hengartner, Michael Møller, Mamokgethi Phakeng, Chorh Chuan Tan

2.3.3 Academic Forum and GESDA Science Breakthrough Radar®

As of February 2023, it is chaired by Michael Hengartner, President of the ETH Board. It is divided into five platforms led by 28 moderators responsible for federating a network of 1180 scientific experts who have helped to identify the major emerging topics within these platforms as well as the major scientific trends with a horizon of 5, 10 and 25 years.

These platforms are:

1. Quantum revolution and advanced artificial intelligence
2. Human augmentation
3. Eco-regeneration and geo-engineering
4. Science and diplomacy
5. Knowledge Foundations (new platform introduced in 2022)

Before the first publication of the radar, the Academic Forum had already mobilized, in 2019 and 2020, 68 scientists to produce 12 thematic *Scientific Anticipatory Briefs* ²⁹.

Bringing scientists to the table of multilateralism

■ Behind GESDA, there is the desire to give more weight to the scientific community in conversations related to global governance. *"Throughout my career, I have been able to realize that scientists are not enough, at the table of multilateralism,*

when they could help policymakers think upstream about the impact of scientific and technological progress on society," laments Patrick Aebischer, Vice-President of GESDA and former President of EPFL.

Bridging the gap between science and diplomacy

■ *"What comes out of the convergence of science and the acceleration of technologies will change the face of the world,"* says Alexandre Fasel, who notes that *"breakthroughs in one field can disrupt many others – for example, quantum technologies can accelerate the development of AI, and then ultimately the field of human augmentation. (Particularly driven by neurotechnologies, editor's note)." To keep the upper-hand, decision-makers should therefore follow developments in several major areas at once, rather than focusing on one or the other.*

"Science and technology are progressing very fast, but diplomacy is moving slowly, building step by step, not, from one resolution to another, a common

basis," adds Alexandre Fasel. And this acceleration of scientific time affects political decision-making. *"We are witnessing a big gap, which is widening more and more: science is moving faster and faster, but diplomacy is struggling to keep up,"* observes Patrick Aebischer.

At the risk of causing a stall? "The danger is that, as an international community, we will only respond to the instantaneous image of science and technology," explains Alexandre Fasel. Because by the time the diplomatic process progresses, we may have responded to a need identified ten years ago, but which is no longer relevant today. It comes down to being interested in a future that ultimately did not happen."

Building a common language

■ For this reason, the GESDA Science Breakthrough Radar® is updated annually. *"Science is progressing at a crazy speed,"* explains Patrick Aebischer. *For example, in neurobiology: it is already possible to develop functional organoids, which is exactly what we feared two years ago."*

"Knowledge societies or funding agencies also lend themselves to the exercise of anticipation," concedes Patrick Aebischer, *"but in a less integrated way and especially without interaction with policymakers."* Doing together is one of the principles of GESDA, and therefore articulate a common language.

2.3.4 Diplomatic Forum

After being chaired from 2019 to 2022 by Michael Møller, former Director-General of the United Nations Office at Geneva, the Diplomatic Forum is chaired since November 2022 by Ambassador Alexandre Fasel, FDFA Special Representative for Science Diplomacy. Members of the Diplomatic Forum include representatives of political, geopolitical and diplomatic circles, representatives of International Organizations in Geneva, *Chief scientists*, scientific advisors attached to governments or intergovernmental organizations, and representatives of the Impact and Citizen communities.

The Diplomatic Forum is the place to accelerate the debate between science and diplomacy, where GESDA tries to transform the Radar into a pipeline of solution ideas and initiatives that can be mobilized in the face of global challenges: health, agriculture, poverty, education, environment, etc. *"If we want science to be at the service of the greatest number and not the prerogative of a few, we must work as soon as possible on scientific emergences to be able to anticipate the opportunities for action and initiatives that they could represent, to accelerate sustainable development for example,"* warns Stéphane Decoutère, Secretary General of the Foundation Board. GESDA also explicitly chooses to focus more on solution opportunities rather than future risks. *"All scientific breakthroughs have two aspects: positive and negative,"* says Peter Brabeck-Letmathe, Chairman of the GESDA Foundation Board and former Chairman of Nestlé. *We can never completely eliminate the negative part, but if we know how to anticipate, we can ensure that the positive aspect predominates."*

Guiding the development of science

■ How can the Radar accelerate the political and diplomatic debates on the emergence of science and technology? *"This can fuel debates about whether or not to patent a technology,"* says Patrick Aebischer. *This is an important dimension that will stimulate – or not – its development."* For Alexandre Fasel: *"Of course, science and technology can contribute to building a better world, but there is also the question of objective limits that it may be wise to place. At the heart of GESDA's thinking is the question of whether we need mechanisms for self-censorship of global science."*

Patrick Aebischer mentions a similar example: chimeras (embryos combining the genomes of several species, intended to advance medicine, which have fueled recent heated debates²³, editor's note). *"This field is still at an early stage,*

but we must ask ourselves some questions today. Should we authorize the filing of patents, authorize scientific publications in this field? Some do not wait: take the 'Crispr babies' (two twins whose genome had been edited in the hope of giving them natural immunity against HIV, editor's note), obtained by a Chinese scientist at the end of 2018."

In March 2019, the scientific community called for a moratorium on heritable genome editing, but establishing rules takes time²⁴. As a result, the WHO had ruled in 2021 on several non-binding recommendations²⁵. Enough to open a breach in which some quickly rushed: a Russian scientist has already announced that he intends to carry out such work²⁶.

2.3.5 Impact Forum and Citizen Forum

These are GESDA's last two forums, which are expected to expand in 2023. They are chaired respectively by Patrick Aebischer (Impact Forum) and Mamokgethi Phakeng (Citizen Forum).

The challenge of the Impact Forum is to provide GESDA with the necessary financial resources to continue its development over the next ten years. Its objectives:

- secure the support of private and public non-commercial partners for its core activities,
- establish ad hoc *impact funds* to provide the necessary resources to implement the proposed solutions,
- integrate local and global actors in innovation and entrepreneurship by enabling them to launch the solutions incubated by GESDA.

Impact Forum communities can be philanthropic actors, venture capital funds, accelerators or start-up incubators, financial sector actors, start-ups, multinationals active in the field of deep tech (which develop disruptive innovations), business platforms, development finance institutions (DFIs)... *"It is important that we onboard the tech world, because if 80% of research is conducted in universities, 20% is conducted in large companies,"* warns Patrick Aebischer. Peter Brabeck-Letmathe explains that *"this is the only GESDA forum that will be able to receive funding from multinationals, or even other governments, because it is a question of developing solutions outside the scope of the foundation."* (see Box 5).

The Citizen Forum launched an exploratory initiative in 2022, the *Youth Anticipation Initiative*, overseen by Mamokgethi Phakeng, initially across South Africa. In 2023, the focus must be on the whole of Africa, before a global transition in 2024. *"The Radar also feeds the Citizen Forum,"* says Peter Brabeck-Letmathe. *"Its role in GESDA's approach, is to allow us to bring citizens back into the conversation about solutions."*

"To succeed, GESDA must be a neutral, honest and transparent intermediary."

■ What are the conditions for GESDA's success and the major challenges ahead for its scale-up?

Interview with Peter Brabeck-Letmathe, Chairman of the GESDA Foundation Board, former CEO of Nestlé and Vice Chairman of the World Economic Forum (WEF).

Can the Radar be of interest to economic actors?

The dimension of anticipation is of course present among economic actors, who devise development scenarios. But this exercise usually takes place at a horizon of 3 years maximum, not at 5, 10 or 25 years. The Radar provides a new vision that can resolutely interest economic actors on what happens in laboratories, since it does not exist anywhere else. Multinationals would not have access to it otherwise. What for? Because they would have to work with scientists from all over the world, and above all, to earn their trust.

We realized that there was also a real interest from the scientific community to participate in the Radar. There are three reasons for this: the feeling of being part of an unprecedented effort and producing something new, the curiosity to understand what is happening in other fields – scientific disciplines are sometimes compartmentalized – and finally, trust in GESDA, which has no commercial interest. This is an essential and critical condition to secure the participation of the scientific community. We act as a transparent and honest intermediary (*honest broker*).

What is this model of the "honest broker"?

We are both a *think tank* and a *do tank*. The *think tank* part must of course find funding. But to guarantee our neutrality and independence, we could not accept funding from multinationals or other countries. That's why we started with funding from Swiss authorities and non-commercial philanthropic foundations. Then there is the *do tank* part: our mission would not be fulfilled if we did not manage to build concrete solutions. However, this does not mean that we will manage everything ourselves.

This is where the Impact Forum, which must translate the solutions proposed by GESDA into concrete innovations, comes into play?

Yes. Funding must be as disinterested as possible for the anticipation and acceleration phases, but the logic can – and even must – be different for the next phase, the translation into concrete initiatives. GESDA is an incubator of solution ideas, which must then be scaled up. We create the pilot projects that we can hand over to third parties and then others can take them on to the next level. This is what the Impact Forum is all about.

GESDA is sometimes compared to the WEF. Have you identified synergies?

GESDA is of course not in competition with the WEF, which is an international body with a very different mission: it brings together the economic and political worlds in order to solve today's problems. GESDA, on the other hand, sees much further. Synergies between the two foundations are possible in the longer term.

We come back to the honest broker dimension: there is more than 800 multinationals funding the WEF, and we must guarantee our independence to the scientists we work with. Consequently, this collaboration could only take place downstream of the proposed solutions, but not upstream.

What are GESDA's major challenges for its growth phase?

I identify two. The first is to develop GESDA's anchoring not only in International Geneva, which is now the case, but also in Geneva itself. The composition of the Foundation Board and our partnership with the Fondation pour Genève are two levers to that end. The second will be to forge more links with German-speaking Switzerland. Internationally, we are seen more as a Swiss foundation than a Geneva one, and this must also be reflected in our activities. In 2023, we are inaugurating a new format of event, launched with the Swiss GESDA Anticipation Days in Zürich, in partnership with the University and the Swiss Federal Institute of Technology in Zurich (ETHZ).

2.4 Funding the activities

2.4.1 Pilot phase

The foundation was initially created for a period of three years (pilot phase), with the possibility in its statutes to “extend the duration of the Foundation for a fixed or indefinite period”, stressing that “an extension of more than five years or of indefinite duration requires the prior consensus of the Founders” – i.e. the Confederation and the Canton of Geneva²¹.

For the three-year pilot phase (September 2019 - September 2022), the foundation had a total budget of CHF 10.1 million, from different sources³⁰.

- **Public funding:** CHF 3.6 million (one third of the total budget)
 - The FDFA for CHF 3 million over three years. This amount was already budgeted as part of the earmarked funding to support measures to strengthen Switzerland’s role as host state for the period 2020-2023.
 - The State of Geneva for CHF 300,000 over the same period.
 - The City of Geneva for CHF 300,000 over the same period.
- **Private funding:** CHF 6.4 million (two-thirds of the total budget)
 - Fondation pour Genève
 - Asuera Stiftung (Horgen)
 - Open Society Foundations (New York)
 - Fondazione Compagnia de San Paolo (Turin)
 - King Baudoin Foundation (Brussels)
 - An anonymous foundation

2.4.2 Scale-up phase

In this new phase of growth, GESDA must scale up to develop several concrete solutions among those tested between 2019 and 2022, including the OQI and the Global Curriculum for Science and Diplomacy. The foundation updated its statutes at the end of 2022 to reflect the extended support from the Confederation and the Canton. The conditions governing the members of the Foundation Board remain unchanged, with the exception of the maximum limit on the number of members, which is increased from 9 to 15.³¹

- **Public funding:** In March 2022, the Federal Council extended and increased its support for GESDA for another ten years, until 2032, followed by the State of Geneva.
 - During this period, the Federal Council contributes CHF 3 million per year. As during the start-up phase, this amount covers about one third of the foundation’s operating costs.
 - The State of Geneva has also proposed to increase its contribution.

2.5 GESDA's achievements

2.5.1 Radar and Summits, at the heart of the methodology

GESDA Science Breakthrough Radar[®] is GESDA’s flagship product. It provides a single-entry point for all communities of practice: political authorities, diplomats, from International Geneva and the global multi-lateral environment, economic actors, NGOs, scientists, etc. It is developed by GESDA in partnership with the Fondation pour Genève and is updated yearly. Two editions of the radar were produced in 2021 and 2022 and released at GESDA’s annual summits.

- For the 2021 edition, 540 scientists identified 24 emerging topics.
- For the 2022 edition: 774 scientists contributed to the identification of 39 emerging topics.
- The 2023 edition of the Radar will include a deep-dive on neurotechnologies, one on the future of war and peace, and finally a third on the right to science, the principle of which is enshrined in Article 27 of the Universal Declaration of Human Rights, which will celebrate its 75th anniversary in December 2023.



For the scientific community, the exercise is not entirely new. “When you are a researcher, you often write funding applications for the coming years, where you imagine the development of your field of study,” says Patrick Aebischer. “Obviously, transposing the exercise to 10 and 25 years is almost science fiction, but we cannot do without this exercise, even if it will of course always remain a part of serendipity in scientific research.”

“Hundreds of scientists from all over the world consider GESDA important enough to collaborate in this undertaking and devote a lot of time to it,” says Michel Mayor, honorary professor at UNIGE, Nobel Prize in Physics 2019 and a representative of the Fondation pour Genève to GESDA. “I share the importance of this goal: the impact of science on society is major and this influence is accelerating. Wanting to ignore it and move forward in the fog is not an option.”

Experts invited to identify emerging topics were selected in collaboration with the open-access scientific publisher *Frontiers*²⁸. The criteria used were:

- the researcher’s H-index, which reflects their “productivity” according to the number of citations of their publications,
- the level of expertise in the emerging themes identified by GESDA within the five platforms,
- Finally, the geographical component has been integrated to the extent possible, to provide for inclusivity and representativity, including experts from less well represented countries.



GESDA’s annual summits are the embodiment of Radar: the sessions reflect its content and open up discussion about it. The first two editions took place in 2021 and 2022 in a hybrid format of about three days at the Campus Biotech, in Geneva.

- **The 2021 edition** consisted of 19 sessions. It welcomed 108 speakers (91 in physics and 17 in virtual), from 33 countries. 939 people participated, including 357 virtually. 38% of participants belonged to the diplomatic community, 23% to the impact community (economic actors, philanthropics, etc.), 22% to the academic community, and 17% to the citizen community.

The first use cases envisaged are the following, as part of a collaboration with the SDG Lab:

- New carbon capture materials
- Tackling antibiotics in wastewater
- Eco-friendly fertilizer production
- Sustainable and nutritious food production
- Optimizing vaccine distribution

A feasibility study in seven chapters is to be completed in 2023 and decides on the use cases that will be selected. CERN, in particular, is consulted in order to best define the governance of the structure.



"It is an excellent signal that CERN has agreed to get involved in the OQI, because CERN is a very good example of multilateralism applied to science," says Patrick Aebischer, who explains the model: "It is important to ensure that quantum technologies are not just the privilege of a few countries or companies, but accessible to all those who would like to leverage them for peaceful use cases, in alignment with the SDGs." Why the SDGs? "Because it is the concentrate of the common good, as the community of nations currently defines it", explains Alexandre Fasel.

How CERN is preparing for the quantum shift

■ *CERN supports GESDA's proposal to create a dedicated institute for quantum technology (OQI) by 2027. And why not? It was in Geneva, at CERN, that the web was invented...*

Interview with Alberto di Meglio, Head of Innovation in CERN's Information Technology Department.

CERN is better known for its particle accelerators than for its interest in quantum technologies, right?

Alberto Di Meglio — I am often asked this question, in two very different ways: either I am asked why CERN is interested in quantum technologies, or I am asked why CERN is not more interested in quantum technologies. Yet quantum physics is at the heart of particle physics, at the heart of what we study at CERN. As for quantum technologies, they must be considered in a broad sense, in particular by integrating the subject of quantum sensors. It's not just quantum computing. Long before we talked about quantum computers, CERN was already manufacturing quantum sensors, for example to study the properties of antimatter.

Why this partnership with GESDA for the OQI? ...

We started from the observation that it was necessary to avoid the creation of a "quantum divide", in the same way that today we observe a digital divide in some parts of the world. Of course, for now, quantum technologies remain expensive, but this question will arise very concretely, even if the cost of access to these infrastructures will fall. We worked with GESDA and other international partners for 18 months to create the OQI concept, which we felt was consistent with CERN's mission. Of course, the core of our business remains physics, but a significant part of our mission is to contribute to society. CERN was consulted to best define this governance, to ensure that the OQI's productions and results do not benefit a single country. We are also a driving force in the development of efficient algorithms in quantum computing – which represents a third of the resources allocated to the *Quantum Technology Initiative* internally.

What is this Quantum Technology Initiative that you coordinate, and who was launched in 2020?

The idea of QTI stems from the broader framework of *CERN openlab*, which I have also overseen since 2012, whose mission, since the early 2000s, has

been to forge public-private partnerships with industry players. Today, we are very interested in all the computational aspects (*data centers, algorithmics, big data, artificial intelligence, editor's note*). The guiding idea is to use new technologies for the benefit of both parties, CERN and industry. In 2017, we started to look at what was being done in quantum computing. Finally, in 2018, we dedicated a large event dedicated to quantum computing applied to high-energy physics in CERN's main auditorium, attended by more than 400 people. We therefore understood that there was a real interest in the field from the community of physicists. Following this, in 2020 we proposed the idea of QTI, which combines all the aspects of interest to CERN of quantum technologies: computing, sensors, communications, but also the theoretical aspect. Today, we have about twenty collaborative projects underway, including with IBM and several universities.

What interest does CERN find in these projects?

QTI remains very focused on physics, on the benefits that CERN has identified for quantum technologies. We want to capitalize on it, even if we are aware that the full potential will not be reached right away. Some quantum sensors could help us detect much lower energy levels. This would be very valuable to perhaps detect new particles outside the Standard Model (*a model that is the "bible of physics", but that we know is incomplete, editor's note*). In addition, there are strategic programs in Europe, Japan and the United States that revolve around these technologies. The idea is for CERN to position itself as a high-level interlocutor on these issues to dialogue with these different stakeholders.

2.5.2.2 The Global Curriculum for Science and Diplomacy

The second flagship project of the foundation is the development of a Global Curriculum for Science and Diplomacy, based on the main principles of GESDA: partnership, anticipation, *honest brokering*, and global action in pursuit of the common agenda of the United Nations SDGs.

The Curriculum aims to train diplomats, scientists, leaders and members of international organizations, as well as members of the private sector in science diplomacy. To develop this solution, GESDA and its partners rely on the first two editions of their pilot initiative: the *Science Diplomacy Week*.



An inaugural edition took place from 16 to 20 May 2022, with a programme of several public conferences and a specific immersion programme dedicated to science diplomacy, with seminars held at the Palais des Nations, WMO, GSPC, the Graduate Institute, CERN, and Campus Biotech. In total, it attracted 604 participants, 171 through virtual sessions and 433 in Geneva (including 30 participants in the immersion programme). Its ambition, at full capacity, will be to accommodate several thousand people per year. The week was reconducted from 8 to 12 May 2023 and is intended to become an annual series.

To organize this event and develop the Global Curriculum for Science and Diplomacy, GESDA federated a network of about twenty partners: the *Geneva Coalition on Anticipatory Science and Diplomacy*. Created in 2022, it brings together the ETH Zurich, UNIGE, the Graduate Institute, the Inter-Parliamentary Union (IPU), CERN, INGSA, the University of Zurich, the SDG Lab run by the United Nations in Geneva, the Geneva Science-Policy Interface (GSPI, hosted by UNIGE), the Diplo- Foundation/Geneva Internet Platform, the United Nations Institute for Training and Research (UNITAR), the International Science Council, the GSCP, SiDLab (hosted by UNIGE and ETH Zurich) and GESDA³⁷.

"The traction we have achieved so far with Science Diplomacy Week as the first demonstrator of such a multi-stakeholder approach to anticipatory science and diplomacy shows that there is an awareness and interest that we can build on," says Marga Gual Soler, Head of *Science Diplomacy Capacity Building* at GESDA.

Why a new curriculum in science diplomacy in Geneva?

■ The educational landscape of science diplomacy remains rather fragmented, despite notable efforts within some universities. Today, most of these courses are delivered by international scientific organizations such as AAAS, The World Academy of Sciences (TWAS) and INGSA³⁸. AAAS and the European Science Diplomacy Project S4DC have launched online courses on science diplomacy.

How is this curriculum developed by GESDA and its partners positioned in this ecosystem? How does it differ from other proposals? *"We have identified gaps in the current educational landscape of science diplomacy,"* says Marga Gual Soler, who has also been involved in the design of several science diplomacy training programs (*Arizona State University* and *AAAS Center for Science Diplomacy*).

Among these shortcomings: the fact that most training is anchored in a given country or region, and this while science and technology are increasingly mixed with the economic, geopolitical and ideological interests of States, and finally the fact that there is still no global consensus on knowledge, Professional skills and networks required to navigate the interface between science and diplomacy at both the national and multi-lateral levels.

The proposal of the Geneva Coalition on Anticipatory Science and Diplomacy should stand out on several points:

– by its anchoring in **collaborative practice** and in the common good. *"The best way to acquire science diplomacy skills is through hands-on experiences to connect knowledge and methods to real-world scenarios,"* says Gual Soler. *"It is not just about understanding the problems, but about developing the capacity to act, exploring the full range of policy options to guide scientific and technological developments to benefit as many people as possible."*

– by its **modularity**, articulating several modules intended for certain audiences around a common framework programme. *"Not everyone needs the same content, at the same level and at the same time,"* says Gual Soler. *"For example, a diplomat would not need an introductory course in international relations. A seasoned climate negotiator wouldn't need the same content as someone new to diplomatic circles. And a Japanese doesn't need the same training as a Brazilian. And we cannot forget the crucial role of business, as many breakthroughs in cutting-edge scientific fields are increasingly being developed in the private sector."*

– and its **geographical location** in Geneva, which is already a key location for global scientific diplomacy. *"There are the examples of CERN, the Graduate Institute, but also the ICRC or the International Telecommunication Union (ITU), which was the first International Organization to settle in Switzerland,"* explains Stéphane Decoutère. *"In this sense, International Geneva carries the Spirit of Geneva, inherited from the Protestant reformer Jean Calvin, founder of the University in 1559, at a time when science and theology were still closely intertwined."*

2.5.3 Other activities

As part of the implementation of the Global Curriculum for Science and Diplomacy, GESDA is also a partner of SiDLab, a laboratory created jointly by the University of Geneva (UNIGE) and the Swiss Federal Institute of Technology Zurich (ETHZ) in October 2021. It was initiated in 2019 by former Federal Councillor Micheline Calmy-Rey, then visiting professor at UNIGE, now a member of GESDA's Foundation Board, and Michael Ambühl, then professor of negotiation and conflict management at ETH Zurich. Bastien Chopard, Director of UNIGE's Computer Science Department, one of the leaders of this project, explains the idea behind this computational diplomacy that Geneva and Zurich want to bring about: *"The principle is to take advantage of computational approaches – algorithms, machine learning, high-performance computing or modeling, for example, by digitizing many documents. From there, we can understand the mechanisms behind the events, or even identify the warning signs."* The laboratory is already working on projects with the United Nations and WHO.

In 2020, GESDA also supported the I-DAIR (*International Digital Health & AI Research Collaboration*) project, which aims to develop digital health and medical AI research in an inclusive and responsible way founded by Indian Abassadeur Amandeep Singh Gill, now the UN Secretary-General's Envoy for Technology.³⁹

3 WHAT POTENTIAL AND WHAT LIMITATIONS FOR GESDA AND SCIENCE DIPLOMACY IN GENEVA?

3.1 What conditions for success?

3.1.1 Explicit objectives

Let us recall the mission of the foundation set out in its statutes³¹:

- identify the major themes of tomorrow's governance (...),
- develop the support modalities by which the various actors, state or not, based in Geneva, Switzerland and throughout the world, can respond together by taking up the challenge of acting at the same pace as scientific and technological acceleration:
 - By taking inspiration from the way the world of start-ups and venture capital works;
 - by involving the great Swiss and global philanthropy
 - and by mobilizing Swiss scientific and technological know-how as a unifying tool in the service of global diplomacy.
- To this end, the Foundation is developing an instrument for anticipation and action, respectively its components, by focusing on public-private partnerships of international scope and projects capable of providing solutions to current and future technological challenges, turning them into opportunities and broadening the circle of beneficiaries of scientific and technological advances.

To do this, the foundation intends to capitalize on four distinctive assets of Geneva and Switzerland:

- a long tradition of research and innovation in science and technology,
- the reputation of Swiss democracy for neutrality, shaped by a dynamic direct democracy,
- the presence of innovative international companies in Geneva and elsewhere in Switzerland,
- the presence of citizens interested in and participating in the management of international affairs.

3.1.2 Successes over the period 2019-2022

The *Key Performance Indicators* (KPIs) for evaluating the foundation have been set jointly by the FDFA, the Canton, the City and the Chairman of GESDA Foundation. Stéphane Decoutère details some of the key achievements:

- *"Despite its youth, GESDA already has a large products portfolio. On the "think tank" side, we have published two editions of the Radar, organize two very high-level Summits, and have proven that our efforts to bridge the scientific and diplomatic communities are working."*
- *"On the "do thank " side, we have laid the groundwork for the Open Quantum Institute, which should be created in 2023, notably through a hackathon on the use of Quantum Computing for the SDGs organized in Abu Dhabi with New York University (NYU), one of the partners of the OQI."*
- *"The high-level political segment that closed the 2022 Summit was a great success for science diplomacy in Geneva with the participation of the President of the Swiss Confederation, the Swiss State Secretary for Education, Research and Innovation and ministers from Abu Dhabi, Singapore, Mexico, Morocco and Estonia. The Swiss embassies with whom we have worked have played a key role in this success, which we want to repeat every year."*

- Mr. Decoutère added that GESDA also fulfills its mission by attracting new leading players to Geneva, whether they belong to the public or private sector, or whether they are philanthropic foundations. *"The fact that Microsoft comes to Geneva to work for the OQI, or that the foundation XPrize has established itself in Europe and has chosen Geneva to do so, are important first steps, says Stéphane Decoutère. The creation of new international events in Geneva, such as our annual Anticipation Summit, contributes to this. These are elements that can contribute to Geneva's influence and its future. This applies both to international organizations and to other actors involved in multilateralism."*
- GESDA has also demonstrated its ability to attract philanthropic funds from the three levels at which it operates: *"Our partners in the 2019-2022 pilot phase reflect these three dimensions,"* Stéphane Decoutère continues. *"For example, at these three levels, we already work with two Geneva foundations, namely the Fondation pour Genève, the Asuera Foundation in German-speaking Switzerland, the Open Society Foundations in New York, the Compania di San Paolo Foundation in Turin and the King Baudouin Foundation in Brussels."*

3.1.3 The Federal Council's long-term outlook

The difficulty for the evaluation of GESDA is that its operation is part of a work in progress: creating new organizations or new public-private partnerships takes time. *"What we are trying to do is very ambitious and must therefore be part of a long-term perspective that allows us to act,"* said Ambassador Alexandre Fasel. *This is why, at the end of its pilot phase, the founders renewed GESDA's mandate for a period of ten years until September 2032. As GESDA's action is long-term, it goes without saying that its work is regularly evaluated".* Béatrice Ferrari, Director of International Affairs of the Canton of Geneva, agrees: *"Understandably, while scientific anticipation arouses a lot of interest, its translation into concrete themes, diplomatic tools and possible solutions is a complex exercise that takes time."*

Paradoxically, it is also the exit clause set from the outset by the Federal Council – a common practice for this type of public funding – that gives GESDA time to build and develop its activities. The Federal Council has thus left itself the possibility of a withdrawal after five years (in 2027), but only under certain conditions, as explained by Alexandre Fasel:

- *"If GESDA's methodology of anticipatory science diplomacy does not work,*
- *if this method works, but there is no market – that is, if the actors of the global government (in this case, International Geneva) do not pay enough attention to it,*
- *or if the world has changed and GESDA no longer meets the original objective needs."*

In other words, if GESDA fulfils its diplomatic function for the Confederation, if it manages engage with actors in global governance, and if the geopolitical and economic context of the world does not undergo any major upheaval, it will have fulfilled its mission in the eyes of the Federal Council.

Why a foundation rather than a public institution?

■ GESDA took the form of a foundation rather than being attached to a federal department or university, like other initiatives promoted by the FDFA such as the GSPI. This choice may make the foundation more vulnerable to a change of responsible minister, but it actually gives it more of the independence it needs to carry out its mission.

"Besides anticipation and being an honest broker (see box 5), what makes GESDA different is its public-private partnership dimension," says Stéphane Decoutère. GESDA is both an instrument that is part of Swiss foreign policy of which scientific and technological diplomacy are a priority, and an autonomous non-profit foundation.

"This is what makes the Swiss approach original and allows us to have a unique value proposition vis-à-vis the partners we support," argues Stéphane Decoutère.

There is more to diplomacy than meet the eye: official diplomacy, *track one diplomacy* and parallel diplomacy, *track two diplomacy*, which relies on more informal networks. At the beginning of 2022, the editor-in-chief of the specialized journal *Science & Diplomacy* and the director of international affairs of the AAAS agreed to consider this second way as necessary, in particular to maintain channels of communication between the United States and China ⁴¹.

One of the singularities of GESDA is that it can play on both sides, while remaining independent. In this sense, GESDA has the potential to overcome the limitations of traditional politics, because at its core, what it does is neither research nor science policy.

"We focus on using scientific advances for the benefit as the many people as possible in the world, insists Stéphane Decoutère. We want to be to multilateral diplomacy what technology transfer is to universities."

Stéphane Decoutère, coming back to relations between Switzerland and the EU, illustrates: *"If Switzerland is currently stuck, it is also because science has become a matter of strategic sovereignty for the European Union as well as for each of the great scientific and technological powers of this world. Consequently, if GESDA wants to have a role to play in accelerating the transfer of knowledge in the diplomatic field, it must find the gap that allows it to escape the logic of blocs that we see resurfacing strongly today, a way to remain global. What we are trying to demonstrate – particularly through the OQI – is that there is a niche of uses, for global and undisputed objectives, here the SDGs and the Common Agenda for the Future promoted by the Secretary-General of the UN."*

Another of its particularities is that it operates at three levels: Geneva, Switzerland and the world, which must also be reflected in its activities:

"Geneva and Switzerland have the priority to implement the solutions we develop, explains Peter Brabeck-Letmathe. But if, for political reasons, they do not want to, we are free to propose them elsewhere, it does not block us."

3.2 GESDA's potential for the future of International Geneva



Like the other centers of global governance, International Geneva is marked by the succession of several global crises: crisis of multilateralism (see 1.1.4), Covid-19 pandemic, war in Ukraine, economic crisis... *"In a particularly unstable geopolitical context, International Geneva and its constituent institutions are under great pressure,"* says Béatrice Ferrari. *We remain convinced that to be effective, multilateralism must promote a higher level of collaboration with different sectors. In this context, the bridge between the actors of science and those of diplomacy is interesting, because it is part of a vast historical heritage. "International Geneva has always combined the scientific component with the humanitarian, economic and political component,"* says Stéphane Decoutère.

This choice is also based on the excellence of Swiss scientific research, which makes Geneva a privileged place for this scientific anticipation exercise: *"There are few scientific places in the world, that are as credible as the Lake Geneva area, with three Nobel Prizes and two Fields medals since 2017,"* notes Patrick Aebischer. But also because the international community has everything to gain: *"Rather than suffer the consequences of the convergence of science and the acceleration of technology, it must be able to grasp the benefits they present and frame the challenges they entail,"* adds Ambassador Alexandre Fasel. *"Multilateral action must therefore go hand in hand with scientific and technological developments. However, this is only possible if it has the anticipatory instrument that is the "GESDA Science Breakthrough Radar®."*

There lies the uniqueness of GESDA's approach: through its instrument of scientific anticipation, the foundation also anticipates the future of multilateral organizations and their renewal. *"If scientific developments change the face of the world, they will also change the way the world is organized,"* says Alexandre Fasel. *If we want to keep Geneva at the center of the world, we need an institution that elevates the debate and strengthens the methodologies of global governance."* *"The current institutions date back to last century, GESDA could eventually lead to the creation of new institutions,"* notes Patrick Aebischer.

The Foundation believes that it has demonstrated its ability to position itself in the ecosystem of International Geneva. This is reflected, for example, in the number of representatives of International Geneva organizations who sit on its Diplomatic Forum (see 2.3.4) and who have expressed interest in anticipatory science diplomacy.

Actors such as the SDG Lab, WFP, ICRC, WHO, UNFCC, WIPO, the United Nations Human Settlements Programme, CERN or UNITAR are involved in major ongoing projects, such as the OQI or the Global Curriculum for Science and Diplomacy. *"So far, the initial phase of the OQI has received the support in principle of 12 universities, 12 permanent representations based in Geneva, 9 international organizations and NGOs, 8 companies active in quantum computing and 2 leading philanthropic actors,"* says Stéphane Decoutère.

Will the curriculum meet its audience? In any case, the timing is wise in view of the growing notoriety of science diplomacy. *"It's no longer a breeze, but not yet a hurricane,"* notes Stéphane Decoutère, who insists on its potential for International Geneva. *"There is an academic development and the emergence of many practical initiatives in the field of official diplomacy ("science diplomacy", "digital diplomacy", "tech diplomacy") but not exclusively. The non-profit sector and that of non-governmental organizations are getting involved: GESDA has carried out a mapping of these actors at the global level, and has already identified a hundred that we would like to invite to take an interest in our work."*

GESDA's activities within International Geneva have the potential to strengthen its global influence, in a rather competitive context: *"The dimension of peace is strongly present in Geneva, but it is not the only one that counts,"* says Patrick Aebischer. *"Cities like Vienna or Singapore also have arguments for global governance, there is competition."* Alexandre Fasel agrees: *"Geneva has a lot of experience in the conversations of international institutions on global governance, it can weigh."* The real test for GESDA will be the test of time, especially to ensure that the Radar remains a relevant and up-to-date reference mapping of scientific knowledge. *"We want to show that we can continue to mobilize the scientific community over time,"* says Patrick Aebischer.

Why anticipation rather than foresight?

■ How does GESDA's approach differ from the more traditional foresight carried out by major economic actors and multilateral organizations? Both approaches share this forward-thinking approach to the future evolution of societies, approaching the subject in two different, and in a certain way, complementary ways:

"Foresight is guided by the identification of risks and major challenges, while GESDA's scientific approach consists first of identifying opportunities, thinking about how we will leverage them, and finally how possible challenges will be addressed" explains Alexandre Fasel. Another difference: foresight leads to scenarios. GESDA's approach,

however, starts by anticipating, identifying opportunities, and then seeking to design solutions together with its communities for the benefit of the common good.

For the actors of diplomacy and multilateralism, this corresponds to a change in culture. *"One of the objective factors of complexity is that the international community is accustomed to devoting all of its energy to the current and imminent challenges it faces,"* Fasel acknowledges. *"Accelerating diplomatic work today on opportunities and challenges that will only arise in the longer term is a new approach which diplomacy must learn."*

3.3 GESDA's potential to develop new economic opportunities.

The Geneva region and the Lake Geneva area have a long tradition of research and innovation, with the proximity along the Lake Geneva region to internationally recognized academic and scientific players (CERN, University of Geneva, EPFL, etc.). The region benefits from a dense economic fabric that houses the headquarters of many multinationals and proximity to financial and economic centers. This fertile context makes Switzerland a country conducive to innovation and entrepreneurship: it ranks among the firsts of 132 countries competing for the WIPO Global Innovation Index in 2022 for the twelfth consecutive year⁴².

In this rich ecosystem, GESDA can play a role at several levels:

- first, through the initiatives it develops through public-private partnerships – for example the OQI – and globally the Impact Forum and the ad hoc impact funds that will be set up depending on the emerging initiatives.

"The OQI embodies one of the ideas behind the Impact Forum," explains Stéphane Decoutère. "Beyond collaboration with private actors, it is a question of promoting a network logic that promotes investment opportunities, direct and indirect." Of course, the solution ideas incubated in this way are not chosen at random: "It's important to choose the right areas that will enrich existing ecosystems," adds Patrick Aebischer. "We are not going to build an "Open Quantum Institute" ex nihilo, where there was nothing! The idea is to build on and enrich the Swiss and Geneva ecosystem."

To fuel the conversation with investors on the OQI, GESDA is developing several use cases for quantum technologies, which will integrate the cost-benefit dimension. In 2023, an argument specifically intended for the philanthropic and financial communities will be unveiled: *"To get them onboard, we must not only have a convincing project supported by the multilateral community, we must also be able to speak their language,"* continues Stéphane Decoutère. *"For example, how quantum can be interesting for foundations or financial actors themselves: it can be mathematical optimization, detection of emerging markets, or quantum cryptography..."*

- The solutions developed focus on a niche of uses for global and undisputed objectives, such as quantum at the service of the SDGs. This positioning allows GESDA not to compete directly with the strategic programs developed by Countries that relate to scientific or technological sovereignty issues. *"The OQI will not prevent States from thinking about military uses of quantum if they wish to do so,"* explains Stéphane Decoutère. *"On the other hand, GESDA can promote 'Good in Tech' and thus contribute to innovation and the effectiveness of multilateral action."*
- Through its Global Curriculum for Science and Diplomacy, GESDA is also an entry point for current and future heads of multinational companies to International Geneva and its multilateral organizations. Among the 30 participants to GESDA's inaugural *Geneva Science and Diplomacy Week* immersion program in 2022 are six personalities from the private sector. Beyond the training aspects, the curriculum also has the potential to attract more international public and private actors to Geneva.
- GESDA can help attract to Geneva and Switzerland a new type of philanthropic actors, from a renewed philanthropy. The Geneva+ working group had identified its emergence as one of the factors that would condition international governance. *"Traditional philanthropy acts in such a way as to leave its successors' capital to perpetuate patronage activities, with a long-term logic,"* explains Alexandre Fasel. *By 'new philanthropy', we mean entrepreneurs who have made a fortune during their lifetime and are willing to spend everything as well during their lifetime, but on condition that their investment has a positive impact on society. A new discipline of 'impact investing/financing' is being established as an instrument of international governance."*

The Bill and Melinda Gates Foundation is emblematic of this trend. In Geneva, it is linked to the global health ecosystem, and largely funds organizations such as the WHO, GAVI (the Vaccine Alliance) or the Global Fund to Fight AIDS, Tuberculosis and Malaria⁴³. The XPRIZE Foundation, which has established its European headquarters in Geneva as part of its collaboration with GESDA, is also part of this new type of philanthropy.

In September 2022, Mara De Monte and Henry Peter, respectively Executive Director and Director of the Geneva Centre for Philanthropy (GCP), affiliated with the University of Geneva, estimated, in an article⁴⁴:

"It is often considered that in Geneva two worlds coexist without interacting: International Geneva and the financial community, separated by Lake Geneva and the Rhône. But this dichotomy is blurring, thanks in part to a third actor: the academic world. The University of Geneva (UNIGE), the Graduate Institute and other academic centers in the Lake Geneva area have significant potential and a role to play in the coming decades to consolidate Geneva as an epicenter working for the common good, with some major trends already emerging." An example? "Building Bridges", a joint initiative launched by the Swiss authorities, the financial community, the United Nations and other international actors to advance sustainable finance." They also cited GESDA's activities, recognizing their potential to inform philanthropy on "how advances in science and technology can be most effectively translated into tools and used for the benefit of humanity."

- The Science Breakthrough Radar, GESDA's scientific anticipation tool, could serve as a compass for investors. *"Scientific developments, when translated into technical developments, impact society,"* acknowledges Jacques de Saussure, former senior partner for the Pictet group. *"These developments require investment. In this sense, they concern the financial sector."* Venture capitalists often have scouting programs to direct investments towards *start-ups*, and it is also this type of actor that GESDA will have to convince.

The financial sector itself is indirectly affected by the multilateral response to major scientific and technological challenges. *"An organization like GESDA would have been very useful in managing the climate crisis 50 years ago, for example,"* says Jacques de Saussure. *"Today, we know that putting a price per tonne of CO₂ is a valid approach, given the effectiveness of the market logic to change human behavior. But if we wish, for this, to fix this price artificially, it requires effective global governance, because no state wants to be the only one to make efforts. In a way, this reflects the need for multilateralism."*

- Finally, GESDA has interesting potential for the economies of emerging and developing countries. *"Thinking in terms of opportunities rather than risks is a matter of development ethics,"* says Stéphane Decoutère. *"We cannot tell people who live below the poverty line or on four dollars a day that they should only be wary of the risks of science when, when asked, they believe that advances in science can help accelerate their development."*

"That's why science is becoming an increasingly important part of diplomacy, economics and society," he adds. *"By working on multilateral and multi-community initiatives like the OQI to anticipate the use of advances in science, we are taking a first step towards globalizing the opportunities. By working on concrete projects, we can at the same time prevent risks and drifts that are always possible on the basis of real experiences rather than abstract fears."*

3.4 The hesitations of the ecosystem

As we have seen previously, GESDA has already achieved several successes, and carries interesting development potential for International Geneva. But any project of this ambition can be subject to tensions or misunderstandings. In the press articles published on GESDA as well as during the interviews conducted for this report, some doubts emerge. We list some of them, in the form of questions, with the answers we have. It should be noted that several people did not wish to be named in this context.

Why cover so many thematic topics?

Through its five academic platforms, GESDA wants to anticipate a wide range of topics, ranging from genetic engineering on humans to decarbonization, conflict digitization, quantum technologies, or space resources, to name a few. This diversity makes it more difficult to read in the eyes of some actors. One interlocutor gave the example of developing global standards for charging electric car batteries to illustrate the kind of concrete topics where GESDA could be useful.

Questions or comments:

- "GESDA could perhaps tighten its scope of anticipation further, to focus first on a few concrete, neutral and not too political subjects, while taking advantage of the diplomatic presence as well as fairly good technical backbone in Geneva," suggests Jacques de Saussure. "The ITU model could be modelled upon, focusing on the development of concrete standards."

Elements of answers. "We are sometimes criticized for having too large a number and width in the choice of our subjects, but we fight to keep it," explains Stéphane Decoutère. "Conversely, we are also criticized for not covering every topic, but on the one hand, we are not intended to be an encyclopedia, and on the other hand the Radar is produced annually by the scientists themselves, so it is an evolving product."

For Patrick Aebischer, the success of the summits helped clarify the Radar. "The risk would be that people don't understand what we're doing. At first, several people told us: but what is this thing? But thanks to the summits, our approach is increasingly recognized, he sweeps. In any case, we welcome the interest shown by the scientific and diplomatic communities."

What scientific anchor for the anticipatory method?

As pollsters know, the methodology influences the results obtained. Among the different methodologies available, GESDA uses that of cross-checking: collecting many people for their opinion to identify the common denominator. The predictions are then reviewed by scientific moderators.

Questions or comments. Johan Rochel, co-founder of the ethical innovation laboratory Ethix in Zurich, and author of an article on the challenges of ethical anticipation for GESDA, recalled in the journal Horizons at the end of 2022⁴⁵: "This method risks ignoring divergent and minority opinions. When we want to know what is cooked in the best laboratories, we also risk identifying only on white, male, fifty-year-old and Western academics. Their vision of the future will be different from that of a young female Chinese scientist. Another point is that contributions are unpaid for most scientists, he added. This de facto excludes those who cannot afford it."

Elements of answers. GESDA already makes an adjustment that considers the geographical component [see 2.5.1]. The foundation is aware of these biases, which it clearly expresses in the methodological section of the Radar, warning that:

- the scientific trends selected by GESDA experts are not intended to be exhaustive,
- the opinions obtained are not representative of the opinion of all experts in a field,

- among participants, mid- and late-career scientists residing in Europe or North America were over-represented.²⁸

Johann Rochel also explained that the interest of the Radar lies more in the approach than in the result⁴⁵: "Most scientific predictions are not going to come true as planned. This does not mean that we should give up anticipation: in this area, the approach counts more than the result. However, it is important to be aware that an anticipation is never neutral and that it has biases."

What market for scientific anticipation?

GESDA does not practice classical foresight, which involves the construction of scenarios for the future, but scientific anticipation.

Questions or comments. For Xavier Comtesse, former diplomat for the Confederation in the United States and creator of the Swissnex network, it is the very concept that poses a problem: "Scientific anticipation is, above all, one of the other names given to science fiction. Foresight is usually more about the technological aspect than the scientific aspect, there is currently no established science of scientific anticipation."

He recalls that the CIA already delivers a regular report⁴⁶, which, like GESDA, maps future scientific and technological progress by 2040. "The question is whether the ecosystem really needs GESDA's Radar."

Elements of answers.

- Box 9 above defined scientific anticipation as a pragmatic approach based on the identification of opportunities to build solutions for the common good.
- The interest, as we saw in Box 3, is above all diplomatic: scientific and technological breakthroughs will impact the world, but also its governance and the institutions responsible for this governance.
- As seen in Part 1, science diplomacy practices must be analyzed in the context of global geopolitical situations. Some actors could thus find it advantageous to rely on a tool complementary to the CIA report.

How do you reach so many different communities?

The GESDA model is influenced by the heterogeneity of the communities with which the foundation operates: scientific, diplomatic, political, philanthropic, economic, financial and citizen.

Questions or comments. This diversity of audiences points to the limits of *one-size-fits-all* communication. How can GESDA improve its *storytelling*? Should they tailor it to those communities? This challenge is all the more notable as the project is articulated step by step and that the Impact Forum and Citizen Forum, which currently exist only in the form of pilots, must be fully developed in 2023.

Elements of answers.

- The diversity of these audiences is at the heart of GESDA's model, says Stéphane Decoutère. "It is precisely key to our mission that we bring together these different communities, while respecting and understanding their specific expectations and constraints, which also differ from place to place in the world."
- Aware of this challenge, the foundation will refine its communication in 2023, in particular by detailing the use cases of quantum technologies on which the OQI will work. Such more concrete communication would also have the potential to increase media coverage of GESDA's activities, providing more explicit angles and "turnkey" subjects to journalists.

What complementarity with other projects supported by the FDFA?

Since 2018, the federal and cantonal authorities have been involved in many projects that may be perceived as related to GESDA. For example, the *Geneva Science-Policy Interface* (GSPI), founded in 2018 by UNIGE with the support of the FDFA, and which aims to support and strengthen collaborative practices at the interface between science and multilateral policy in the context of International Geneva. Another example is the *Building Bridges Summit*, which aims to put the financial sector at the service of the SDGs through sustainable finance. A project led by the banker Patrick Odier, supported by the Canton and the City of Geneva, and for the federal departments, by the State Secretariat for International Financial Matters (SIF), the State Secretariat for Economic Affairs (SECO) and the FDFA.

Questions or comments. Are there more synergies to develop between these different projects? Could the authorities communicate more about their complementarity?

Elements of answers.

- Synergies are already at work between GESDA and the GSPI, one of the founding members of the *Geneva Coalition on Anticipatory Science and Diplomacy*, which co-organizes the Science Diplomacy Week. "The resources developed by the GSPI – studies on interface practices in Geneva, workshops... – should be part of the *Global Curriculum for Science and Diplomacy* developed by GESDA, among others," explains Nicolas Seidler, director of the GSPI, who points out that the teaching material developed by the GSPI is also used in other settings, such as for the Diplo-Foundation's training on science diplomacy or a summer school organized at the University of Geneva, as well as during interventions in the doctoral schools of UNIGE, EPFL.
- A partnership with Building Bridges around the SDGs, for example, could be an interesting complement to GESDA.

What anchorage for the Citizens' Forum in Geneva?

The GESDA Citizen Forum started in 2022, as an exploratory initiative focused on South Africa. It is expected to grow and reach the African continent in 2023 and to become global in 2024. It must feed the societal debate on the breakthroughs identified by the Radar.

Questions or comments. Could the Citizen Forum further develop its Swiss / Geneva roots?

Elements of answers. The two editions of the Geneva Science and Diplomacy Anticipation Summit each included a public plenary session:

- During the 2021 summit, a public conference entitled "How to anticipate, support and share the scientific revolutions to come?", in partnership with IHEID and the Fondation pour Genève, including former Italian Prime Minister and President of the Jacques Delors Institute Enrico Letta.
- At the 2022 summit, a public lecture in English on new economic and geopolitical frontiers in the field of synthetic biology.

GESDA is thinking about further developing its engagement with the citizens of Geneva in the coming months. Other events addressed to the Geneva public have been organized, such as a show at the Saint-Gervais theater in October 2021 - a reading in English of the book *Frozen Sea* by Californian author Maury Zeff, which went unnoticed in the French-speaking press.

What vulnerability to a possible change in the FDFA's strategy?

GESDA took the form of a foundation (see Box 8). For some, this allows GESDA to remain independent. For others, it increases its dependency to the political sphere.

Questions or comments. "GESDA could have chosen to be affiliated to a university, or to a federal department, rather than take the form of a foundation," says Xavier Comtesse. "This would reduce its vulnerability to possible future changes in the responsible minister."

Elements of answers.

- They can be found in Box 9. GESDA's founding form is adapted to its mission, which also consists of influencing *track two diplomacy*, and being able to interact with the private sector.

3.5 Recommendations

At the end of the above analysis, we have selected six recommendations to develop the potential of the anticipatory science diplomacy implemented by GESDA within the Geneva, Swiss and global ecosystem. This cannot be claimed as exhaustive.

3.5.1 For the authorities (Confederation and Canton)

- Develop the complementarity of supported initiatives with obvious links to GESDA, for example, with Building Bridges on the SDGs.
- Focus the communication on the complementarity of the science diplomacy initiatives they support.

3.5.2 For GESDA itself

- Adapt its communication and create different narratives adapted to the diversity of audiences and projects, more focused on concrete use cases.
- Strengthen its presence in the Geneva public space, targeting citizens, including beyond the Summit.
- Justify the very broad spectrum of topics covered by scientific anticipation, perhaps by communicating better on identified but less mature solutions than the *Global Curriculum for Science and Diplomacy* and the OQI.
- Develop bridges with other innovation ecosystems in Switzerland, particularly in German-speaking Switzerland (Zurich, Basel, etc.).

CONCLUSION

The GESDA project for science diplomacy and international Geneva is ambitious, not to say audacious. Its mission is altogether anticipatory, diplomatic, and constructive, aiming to develop solutions for the benefit of the common good. It involves actors as diverse as the scientific community, Swiss and global philanthropy, the diplomatic community, investors, as well as citizens and economic actors willing to implement the solutions emerging from GESDA.

It is this richness that creates the complexity – as well as the singularity and interest – of its model. Inspired by start-ups, it must also attract financial and economic actors, including commercial ones, in its Impact Forum.

In 2023, the last pieces of the puzzle should finally fit together: the Citizen Forum and especially the Impact Forum, must become operational. The diplomatic community already seems to be convinced. 2023 will therefore be a pivotal year for the Impact Forum.

Such an ambitious project is bound to find itself at the crossroad of tensions. One of the difficulties GESDA faces is the time required to create and deploy solutions, whether it is a new international institute, a laboratory, or a framework agreement... In 2022, the Federal Council and the State of Geneva extended GESDA's mandate for ten years to fully prove itself. This will be one of the challenges facing the OQI: to show that the solutions proposed by GESDA can be scaled up in a few years.

In any case, the foundation has made a wise strategic decision, placing the SDGs at the heart of the solutions it incubates. The SDGs 2030 targets have a closer horizon than those 10 or 25 years used during the anticipation phase. This will anchor GESDA in a concrete need and will benefit International Geneva. All the initiatives that GESDA will propose – incubate or launch might not take-up, this is one of the characteristics of the start-up world, one of its models. However, regardless of the outcome, it will have created ideas and animated the Swiss and Geneva ecosystem, planting seeds for the future.

Its success or failure will not depend only on GESDA, but on the entire Geneva and Swiss ecosystem, and its ability to embrace the open network mindset promoted by the foundation: GESDA is a global player, serving an ambition that goes beyond the Swiss borders. *"Any initiative of this ambition involves risks," wrote journalist Stéphane Bussard in Le Temps in 2021⁴⁸. The responsibility for success or failure will lie primarily with GESDA, but also with all actors in International Geneva, public and private. In the end, its purpose is not just Geneva, it is all humanity."*

LISTS OF PERSONS CITED

In alphabetical order:

- **Patrick Aebischer**, Vice-Chairman of the GESDA Foundation Board and former President of EPFL
- **Peter Brabeck-Letmathe**, Chairman of the GESDA Foundation Board, also Vice-Chairman of the World Economic Forum and former Chairman of Nestlé SA.
- **Bastien Chopard**, Director of the Computer Science Department at UNIGE
- **Xavier Comtesse**, former diplomat for the Confederation in the United States and creator of the swissnex network
- **Stéphane Decoutère**, Secretary General of the GESDA Foundation Board
- **Alexandre Fasel**, Ambassador, FDFA Special Representative for Science Diplomacy
- **Béatrice Ferrari**, Director of International Affairs of the Canton of Geneva
- **Fabiola Gianotti**, CERN Director-General
- **Marga Gual Soler**, Head of Science Diplomacy Capacity Building à GESDA
- **Michel Mayor**, Honorary Professor at UNIGE, Nobel Prize in Physics 2019 and representative of the Fondation pour Genève to GESDA
- **Alberto di Meglio**, Head of Innovation in CERN's Information Technology Department
- **Jacques de Saussure**, former senior partner for the Pictet group
- **Nicolas Seidler**, Director of the Geneva Science-Policy Interface (GSPI)
- **Mara De Monte**, Executive Director of the Geneva Centre for Philanthropy (GCP), University of Geneva
- **Henry Peter**, Director of the GCP

APPENDIX

Description of the Swiss ecosystem involved in GESDA or science diplomacy

This description establishes, **without pretending to be exhaustive**, the list of the main stakeholders (or potential stakeholders) with the activities of GESDA or other activities under scientific diplomacy. It follows the typology established in 1.2.1. The actors are listed by category and alphabetically.

For more specific lists relating to global health, internet governance or climate emergency, please refer to previous bulletins published by the Fondation pour Genève on these themes.

A.1 Geneva-based international organizations

The descriptions of the actors are taken from the website on International Geneva of the Canton of Geneva.

- **IAEA (International Atomic Energy Agency)**
<https://www.iaea.org/>
- **UNESCO International Bureau of Education (IBE UNESCO)**
Link to GESDA: Lidia Brito, Director of UNESCO's Regional Bureau of Science in Latin America and the Caribbean, sits on the Diplomatic Forum.
<http://www.ibe.unesco.org>
- **United Nations Office for Disaster Risk Reduction (UNDRR)**
Link to GESDA: Mami Mizutori, Special Representative of the UN Secretary-General for Disaster Risk Reduction (UNDRR), sits on the GESDA Diplomatic Forum
<https://www.undrr.org/>
- **International Committee of the Red Cross (ICRC)**
Link with GESDA:
 - Peter Maurer, former president of the ICRC, sits on the Diplomatic Forum
 - The ICRC is a partner of the Open Quantum Institute.
<https://www.icrc.org/>
- **United Nations Framework Convention on Climate Change (UNFCCC)**
Link to GESDA: The UNFCCC is a partner of the Open Quantum Institute.
<https://unfccc.int/>
- **International Federation of Red Cross and Red Crescent Societies (IFRC)**
<https://www.ifrc.org/>
- **United Nations Children's Fund - UNICEF**
<https://www.unicef.org/>
- **GAVI**
<https://www.gavi.org/>
- **Global alliance for improved nutrition (GAIN)**
Link to GESDA: GAIN is a partner of the Open Quantum Institute.
<https://www.gainhealth.org/>
- **Office of the United Nations High Commissioner for Human Rights (OHCHR)**
<https://www.ohchr.org/>
- **United Nations High Commissioner for Refugees (UNHCR)**
<https://www.unhcr.org/>
- **United Nations Office at Geneva (UNOG)**
Link with GESDA:
 - Michael Møller, former Managing Director of the United Nations Office at Geneva sits on the Foundation Board.
 - Jürg Lauber, Ambassador, Permanent Representative of Switzerland to the UN and other international organisations, sits at the Diplomatic Forum
 - Event at the Palais des Nations during the inaugural edition of Science Diplomacy Week.
<https://www.ungeneva.org/>
- **European Organization for Nuclear Research (CERN)**
Link with GESDA:
 - Fabiola Gianotti, Director-General of the European Organization for Nuclear Research (CERN), sits on the Foundation Board
 - CERN is a partner of the Open Quantum Institute
 - Le CERN et partenaire de la Geneva Coalition on Anticipatory Science and Diplomacy
 - Event at CERN during the inaugural edition of Science Diplomacy Week
<https://home.cern/>

- **International Organization for Standardization (ISO)**
Link to GESDA: Sergio Mujica, ISO Secretary-General, sits at the Diplomatic Forum
<https://www.iso.org/>
- **International Labour Organization (ILO)**
Link to GESDA: Guy Ryder, Director-General of the ILO, sits on the Diplomatic Forum.
<https://www.ilo.org/>
- **World Meteorological Organization (WMO)**
Link to GESDA: Event at WMO during the inaugural edition of Science Diplomacy Week.
<https://public.wmo.int/>
- **World Intellectual Property Organization (WIPO)**
<https://www.wto.org/>
- **World Trade Organization (WTO)**
<https://www.wto.org/>
- **World Intellectual Property Organization (WIPO)**
Link with GESDA:
 - WIPO Director General Daren Tang Sits at the Diplomatic Forum
 - WIPO is a partner of the Open Quantum Institute.
<https://www.wipo.int/>
- **World Health Organization (WHO)**
Link to GESDA: WHO is a partner of the Open Quantum Institute
<https://www.who.int/>
- **Food and Agriculture Organization of the United Nations (FAO)**
<https://www.fao.org/geneva/en/>
- **United Nations Industrial Development Organization (UNIDO)**
<https://www.unido.org/>
- **World Food Programme (WFP)**
Link with GESDA: WFP is a partner of the Open Quantum Institute.
<https://www.wfp.org/>
- **United Nations Development Programme (UNDP)**
<https://www.undp.org/>
- **International Telecommunication Union (ITU)**
<https://www.wto.org/>
- **Inter-Parliamentary Union (IPU)**
Link with GESDA:
 - Martin Chungong, IPU Secretary General, sits at the Diplomatic Forum
 - Partner of the Geneva Coalition on Anticipatory Science and Diplomacy
<https://www.ipu.org/>

- **United Nations Institute for Training and Research (UNITAR)**
Link to GESDA: partner of the Geneva Coalition on Anticipatory Science and Diplomacy
<https://www.unitar.org/>

A.2 Academic and university community

- **University of Geneva (UNIGE)**
Link with GESDA:
 - Partner of the Open Quantum Institute
 - Co-founder of SiD Lab, partner of GESDA
 - Partenaire de la Geneva Coalition on Anticipatory Science and Diplomacy
 - Several UNIGE researchers or professors are experts or moderators within the various platforms of the Academic Forum.
- **University of Zurich (UZH)**
Link with GESDA:
 - Partner of the Geneva Coalition on Anticipatory Science and Diplomacy
- **University of Lausanne (UNIL)**
- **Swiss Federal Institute of Technology Zurich (ETHZ)**
Link with GESDA:
 - Partner of the Open Quantum Institute
 - Co-founder of SiD Lab (see Box 7), partner of GESDA
 - Partenaire de la Geneva Coalition on Anticipatory Science and Diplomacy
 - Joël Mesot, President of ETH Zurich, was co-chair of the Academic Forum with Martin Vetterli (President of EPFL) from 2019 to 2022.
 - Several ETH Zurich professors are experts or moderators on the various platforms of the Academic Forum.
- **Swiss Federal Institute of Technology Lausanne (EPFL)**
Link with GESDA:
 - Partner of the Open Quantum Institute
 - Martin Vetterli, President of EPFL, was co-chair of the Academic Forum with Joël Mesot (President of ETH Zurich) from 2019 to 2022.
 - Several EPFL researchers or professors are experts or moderators within the various platforms of the Academic Forum.
- **Board of the Swiss Federal Institutes of Technology (ETH Board)**
Link to GESDA: Michael Hengartner, President of the ETH Board, has been chairing the Academic Forum since February 2023.

- **Swiss National Science Foundation (SNSF)**
Link with GESDA:
 - Matthias Egger, President of the Research Council of the Swiss National Science Foundation (SNSF), was a member of the Foundation Board until November 2022.
- **Geneva Centre for Security Policy (GSCP)**
Link with GESDA:
 - Partner of the Geneva Coalition on Anticipatory Science and Diplomacy
<http://www.gcsp.ch/>
- **Graduate Institute of International and Development Studies (IHEID) / Geneva Graduate Institute**
Link with GESDA:
 - Event at the Geneva Graduate Institute during the inaugural edition of Science Diplomacy Week.
<http://graduateinstitute.ch/>
- **University of St. Gallen (HSG)**
Link with GESDA:
 - Partner of the inaugural edition of Science Diplomacy Week.

A.3 Geneva diplomatic community

- **Foundation for Geneva**
Link with GESDA: the Fondation pour Genève is one of its main partners.
- **DiploFoundation / Geneva Internet Platform**
Link with GESDA: partner of the Geneva Coalition on Anticipatory Science and Diplomacy
<https://www.diplomacy.edu/>

A.4 Multi-stakeholder initiatives

- **Building Bridges**
- **SDG Lab**
Link with GESDA:
 - SDG Lab is member of the Geneva Coalition on Anticipatory Science and Diplomacy
 - SDG Lab is also a partner of the Open Quantum Institute, whose use cases must focus on the United Nations Sustainable Development Goals (SDGs).
 - SDG Lab is also a partner of the Geneva Coalition on Anticipatory Science and Diplomacy
<https://www.sdglab.ch/>
- **GSPI**
Link with GESDA:
 - Partner of the Geneva Coalition on Anticipatory Science and Diplomacy
<https://gspi.ch/>

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