EDITOR
Marilda Solon Teixeira Bottesi

FESTSCHRIFT

in honor of

CARLOS HENRIQUE DE BRITO CRUZ

CONTRIBUTION TO THE DEVELOPMENT OF RESEARCH AND INNOVATION

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Preface

THE "BRITO CRUZ EFFECT" IN S&T POLICY FORMULATION

Marilda Solon Teixeira Bottesi, Renato Atílio Jorge

We met Brito at the University of Campinas (UNICAMP) in the 1980s. Our first interaction with him was in the Teachers' Association (ADUNICAMP), first as members of the board of representatives and, later, on its Executive Board. Our personal affinity began and became stronger based on our shared goal of contributing to UNICAMP's excellence and fostering research excellence in the State of São Paulo.

One of the main challenges we faced at the time was achieving autonomy in teaching, science, administration and financial management for São Paulo's three state-run universities: UNICAMP, São Paulo State University (UNESP) and the University of São Paulo (USP). Brito took part in the discussions and proposals on the formulation of proposals for university autonomy, adding his voice to those of the State of São Paulo's academic community, which participated intensely in the process. This organized political pressure resulted in a decree assuring autonomy for the three universities, signed by the State Government on February 2nd, 1989, bringing along well-know benefits to all players involved.

Another important undertaking in which Brito and the academic community joined forces was the movement for an increase in the tax revenue to be allocated to FAPESP. Until 1985, the São Paulo State Treasury transferred funds with a delay of two years. The proportion

of the State's ordinary revenue then transferred was 0.5%. The two-year lag reduced the proportion to 0.27% in real terms. The Amendment 39/1985 to the State's Constitution established monthly transfers, each corresponding to one-twelfth of the previous year's budget. This measure enhanced FAPESP's long-term planning capacity, an invaluable benefit at a time of hyperinflation in Brazil.

Another relevant step was taken in October 1989, when the State of São Paulo promulgated a new Constitution. Article 271 raised the proportion of tax revenue to be allocated to FAPESP from 0.5% to 1%, marking another advance in the funding for scientific and technological research in State of São Paulo. Again, the academic community strongly coordinated efforts to win this increase for FAPESP, with Brito participating alongside the faculties of the three state-run universities.

Brito played a remarking institutional role at UNICAMP. Between 1991 and 1994 and again between 1998 and 2002, he was the Director of the Gleb Wataghin Institute of Physics (IFGW). Between 1994 and 1998 he was UNICAMP's Research Chancellor, and between 2002 and 2005 he was President of UNICAMP. We witnessed each of these activities at close quarters, especially during his time as President, when we served as his chiefs of staff.

Brito's institutional journey at FAPESP started in 1996, as President of the Board of Trustees, until 2002. During this period, he introduced major innovations to FAPESP, championing the creation of the Innovative Research in Small Business Program (PIPE) and the Research, Innovation and Dissemination Centers (RIDCs). In April 2005 he took office as Science Director of FAPESP.

As a great formulator of science and technology policy, Brito has brought remarkable ideas to FAPESP, significantly driving the advancement of scientific knowledge.

We dedicate this book to thanking and honoring Brito. Owing to his keen intelligence and indefatigable capacity for hard work, his tenure

resulted in innumerable benefits both for FAPESP and for academic community of the State of São Paulo, as detailed in the ensuing pages.

We often playfully refer to Brito as a kind of octopus, bearing many more than eight right arms. His Scientific Directorate staff, the arms of the octopus, describe in this book the process of formulation, construction and execution of what has become known in house as the "Brito Cruz effect" during his 15 years in office.

Another dimension of the "Brito Cruz effect" is portrayed in these pages by some of his foremost partners: scientists, science policymakers, and administrators of research funding institutions in the State of São Paulo and elsewhere.

We would like to stress how enjoyable, stimulating and challenging it has always been for us to accompany Brito in his political and administrative activities, and as his close aides to witness the rise of FAPESP's importance to São Paulo, to Brazil and to the world.

TABLE OF CONTENTS

FAPESP GOVERNANCE 11
13 President
19 Executive Board

GREAT PARTNERS WORLDWIDE 23
25 Brazilian Ministry of Foreign Affairs
31 National Science Foundation (NSF)
33 UK Research and Innovation (UKRI)
36 German Research Foundation (DFG)
41 European Union (EU)
44 Netherlands Organisation for Scientific Research (NWO)
48 UK: British Embassy, Newton Fund and British Consulate General
53 UK: Biotechnology and Biological Sciences Research Council (BBSRC/UKRI)
56 National Research Council (CONICET), Argentina
58 National Research Foundation of South Africa (NRF)
61 Social Sciences and Humanities Research Council of Canada (SSHRC)
64 Brazilian National Council of State Funding Agencies (CONFAP)

UNICAMP 69
71 University of Campinas

SÃO PAULO RESEARCH FOUNDATION (FAPESP) 79
Adjunct Panel (CAD) **79**
81 Life Sciences
85 Physical Sciences and Engineering
90 Research for Innovation

96 Social Sciences and Humanities
98 Special Programs and Collaboration in Research
112 Multi-user Equipments

Special Programs Committees 117
119 BIOEN
123 BIOTA-FAPESP
129 eScience
132 Program Evaluation
136 Research Program on Global Climate Change

Scientific Directorate – Team 141
143 Advisors
151 Managers
157 Proposals & Follow up Management Team
161 Assistants

Communicating Science to the Public 163
165 Virtual Library
171 Special Program in ST&I Indicators
180 *Pesquisa FAPESP* magazine
184 Communication Department

APPENDIX I – AUTHORS 193

APPENDIX II – FAPESP'S COLLABORATION AND CO-FUNDING IN RESEARCH 197

MAP OF AGREEMENTS (BACKOVER INSIDE)

FAPESP GOVERNANCE

President

Executive Board

FAPESP

THE PERMANENT SEARCH FOR EXCELLENCE IN RESEARCH

Marco Antonio Zago, President

The São Paulo Research Foundation (FAPESP) was created by law in 1960 and started its activities in 1962. In almost sixty years it became one of the most prominent agencies of research support of the country. Its stability and efficiency over decades contrast with a history of highs and lows of the national policies of science and technology, and the permanent swings of the economic and the political environment of the country.

There are three reasons for this success. The first important cause is the foresight of the political, economic and academic elite of the State of São Paulo who, in 1947 and 1988, introduced an article in the State Constitution that recognized that the support of the science and technology research is a mission of the State, and determined that 0.5% (later increased to 1.0%) of all the State revenues be directed to this objective, under the responsibility of a Sate Foundation.

The second reason for success is that the law guarantees the autonomy of the Foundation, with an independent Board of Trustees, who has complete freedom to use the funds to promote research, associated with very simple but effective rules, such as that it can spend only up to 5% of its budget for administration, and that it should support research instead of doing research or hiring permanent research personnel.

The third element that contributes to FAPESP's success is the permanent search for excellence. This value is generally recognized as a hallmark of the institution. Researchers looking for support know that only the best proposals have a chance to be funded. FAPESP is viewed as a model not only for the quality of research support, but also because it is a hub that promotes science cooperation and stimulates competitive research that has social and economic impact.

In this scenario, the Science Director of FAPESP is a keyperson to assure that all the programs and every project supported by the Agency reach a level of excellence. This is not a simple task, if we consider that in 2018 the Agency analyzed 19,724 new proposals, and approved 10,946. Carlos Henrique de Brito Cruz leaves the office of Science Director after serving for five three-year periods; the length of his tenure, and the five-time renewed endorsement by the Board of Trustees, is by itself a testimony of his ability to promote the main value of the agency, the search for quality.

I knew personally the eight Science Directors of FAPESP, and worked with many of them. My relationship with Brito covers an especially relevant period of my life, when I changed from being a research team leader to become the president of the National Research Council (CNPq), and afterwards the Research Vice-President of University of São Paulo (USP), the President of USP, and finally the President of FAPESP.

Thus I have had ample opportunity to work together with Brito in science policy before assuming the FAPESP Presidency. From my standpoint, our most relevant joint contribution to Brazilian science was the program of the National Institutes of Science and Technology, which was launched in 2008. The program was my responsibility as president of the CNPq, and three persons helped in its conception: Sergio Rezende (then Minister of Science and Technology), Brito Cruz and J. R. Drugowich (one of the directors of CNPq and today

a member of FAPESP's staff). Brito was decisive to bring the financial partnership of FAPESP to that federal program, tipping the balance that helped attract many other institutions and put together the financial and strategic support that resulted in one of the strongest research program in recent years in Brazil (in the order of 500 million dollars PPP[1]).

I wish to emphasize three aspects of Brito's achievements throughout his 15 years in office. First of all, I would point out his strong determination to promote both research quality and expansion in the State of São Paulo. The decade of 1990 saw the consolidation of "big science" in the State, with the expansion and institutionalization of research in the universities, research institutes and industries. In 2005, when Brito became Science Director, FAPESP had started to support strategic programs more strongly, as was the case of the Genome Project, the Cancer Genome Project, the Bioen Program for Bioenergy and the Biota Program of Biodiversity. The Program of Research, Innovation and Dissemination Centers (CEPIDs) had started in 2001, and developed during his tenure; its success led to a new phase of this 11-year duration program in 2013, with the participation of 17 centers. At the same time, he drew attention to importance of expanding the post-doctoral programs in the universities, as a strategy for quality training of new researchers and for enlarging the research force; the response was clear: the number of post-doctoral fellowships awarded by FAPESP increased from an average of 300 annually, in the 10-year period of 1995-2004, to an average of 700 fellowships annually in the period of 2005-2019.

Secondly, Brito conducted the FAPESP's policy to increase support of research for innovation and of the programs that promote or facilitate the university-industry collaboration in research. The table shows that the increase of the special, strategic and technological innovation projects is an evident change of FAPESP's profile between the years 2007 and 2019.

1 Purchasing Power Parity (PPP)

I shall mention two examples of his efforts in this direction, not only because they are representative of the success of the foundation but also because I know that he is particularly proud of these achievements.

Table 1. FAPESP – 2007 and 2019

	(Million Dollar PPP)			
Year	2007	2019	2007	2019
Programs				
Fellowships	156.5	241.8	12,808	14,438
Regular Research Grants	142.3	101.8	7,162	5,662
Advanced Research Support	91.3	113.4	944	915
Strategic & Technologic	12.8	40.1	488	451
Innovation	42.8	59.9	1,529	2,785
Research Infrastructure	37.3	53.8	369	532
Science Communication	–	8.9	-	23
Total	482.9	619.7		

One is the *Program of Innovative Research in Small Business (PIPE)*, established in 1995, that supports research in small companies, and requires that the principal investigators have a job contract with the company. In February 2020 there were 337 active projects, and a total of 1,998 grants had been awarded since its beginning, comprising small companies that are located in over 140 municipalities of the State of S. Paulo. The growth of this program is again obvious: an annual average of 58 grants in the period of 1998-2005 increased to 186 grants annually in 2013-2019. Positive outcome indicators are the increase of the average number of the company's employees (8.1 before to 11.1 after), the average number of P&D employees (1.3 before to 3.8 after), and the six-time return of the investment as an increase of the tax payed

by companies. Many of the companies are start-ups and spin-ups of the universities associated with high success rate.

A successful model of university business collaboration is represented by the *Program of Engineering or Applied Research Centers*; it has similarities with the NSF Program IU-CRC.

Each center needs a shared project and shared investments between a large company and FAPESP. The center is located in a university or research institute. The first grant was awarded in 2012, and there are at the moment a total of 14 centers with companies such as Peugeot-Citroën, Shell, IBM, Equinor, Embrapa, GSK and IBM. The total investments for the next 10 years make this the biggest program of university-business cooperation in Brazil.

The strategy of promoting research for innovation accounts for 10% of FAPESP investments, and it contributes to the participation of companies in the R&D of São Paulo, as well as the university-company collaboration. São Paulo is the only State in Brazil in which the contribution of the private sector to the R&D expenditure (56% private x 44% government) exceeds the government expenditure, and the number of scientific articles with at least one author from the academy and one from the industry multiplied nine folds from 60 in 2000 to a total of 570 in the year of 2018.

Finally, the last decade saw a significant increase in the international collaboration of scientists and research institution of the State of São Paulo. This was the result of synergistic initiatives by the universities and the growing support by FAPESP. The universities of the State of São Paulo organized their own internationalization programs, promoted exchange and set up bilateral or multilateral research collaboration with foreign institutions. Within FAPESP, Brito had a leading role in this aspect, especially in promoting active interaction with many international agencies and universities, as well as formatting the flexible programs to fit

different demands from partner institutions. I would stress, as examples of successful and fruitful collaboration, the partnerships with the NSF of USA, with DFG, the Research Councils of UK (UK Research and Innovation), among many others. As a consequence, the percentage of articles with coauthors from foreign countries published by researchers of São Paulo increased from an average level of 27% through the decade of 2000 to almost 40% recently.

As President of FAPESP I wish to emphasize the contribution of Carlos Henrique de Brito Cruz for the strengthening of science and technology in the State of São Paulo. He went far beyond the results expected from the science director; he has been a driving force acting within and outside FAPESP, always willing to discuss new strategies of research support, always challenging directors, presidents, vice-presidents for research and for graduate studies of universities, institutes and companies to increase, focus and search for quality in research. Moreover, his opinions are well respected by the Brazilian science community, his voice carries the weight of a recognized leadership.

Personally, I have always had a good time working and arguing with Brito. With his scientific trained mind he seems to be permanently challenging, although he is a very able negotiator and friendly work partner. I am sure that I will miss him at FAPESP.

FAPESP
Executive Board

WHEN PATHS CROSS

Carlos Américo Pacheco, Fernando Menezes de Almeida, Joaquim José de Camargo Engler

Brito sat on FAPESP's Executive Board throughout the 15-year period during which he was the Scientific Director, alongside the Chief Executive and Chief Administrative Officers. His contribution in this period to FAPESP, as a whole, and to the Executive Board, in particular, was extraordinary. It derived from his personal experience as an outstanding scientist and from his administrative experience as a former university rector and as a former President of FAPESP (1996-2002).

His strategic vision of FAPESP's role, as well as his combination of creativity and executive capacity, on the one hand, and his mastery of information on the world of science and technology, on the other, enabled him to conduct with precision the process of enhancing and extending the range of FAPESP's programs, which now enjoy worldwide recognition.

By the way, thanks to these qualities, through policies supported by the Executive Board and by the Board of Trustees, FAPESP has achieved international projection and built strong and productive relationship with the world's leading funding agencies and universities.

Brito's contributions to the activities of the Executive Board, and here we can speak particularly of our experience in recent years, were characterized by harmony without relinquishing a firm and respectful

discussion of different views. To cite but one emblematic example, in a period of nearly three years, the Executive Board made all decisions by consensus, albeit starting from divergences.

In recent years, we have introduced a number of changes to FAPESP. Brito's input was consistently decisive in ensuring that we could do it in a highly positive manner for the Foundation's future. His knowledge of processes, numbers and details of FAPESP's day-to-day activities played a major role in shaping the final decisions. He had an extraordinary capacity for hard work and an enviable readiness to respond with speed and attention wherever he might be in the world. Perhaps, however, his most memorable qualities were the clarity of his vision and his professional and personal dedication to the Foundation. FAPESP as it is today owes a great deal to him in terms of its operations and policies, but also in terms of its organizational culture, which places a high value on excellence, meritocracy and the pursuit of creative ways to foster world-class scientific and technological research in the State of São Paulo.

Each one of us with our different life courses has shared with Brito rich and stimulating experiences in different positions and at different times, as briefly commented below:

I first met Brito when he was a member of FAPESP's Board of Trustees. He later became President and, then, Scientific Director. As a member of the Executive Board and Chief Administrative Officer, I have had an excellent and highly productive relationship with Brito, who, with brilliance and intelligence, has done a magnificent job, introducing numerous innovative programs that have enlarged and enhanced FAPESP, just as he had done at other institutions he led, especially UNICAMP.

Joaquim de Camargo Engler,
Technical Coordinator, Office of the CEO

I first met Brito when he was President of the University of Campinas (UNICAMP) and, at that time, I was the second-in-command at the São Paulo State Department of Science, Technology and Economic Development. We used to have very fruitful relation between the State Department and the presidents of São Paulo's public State universities (USP, UNICAMP and UNESP), both individually and via CRUESP, the association that represents them. From that time, I have excellent memories of my personal relationship with Brito, who collaborated directly with several strategic programs of the state government, such as the master plan for higher education, the drafting of a law to foster innovation (Supplementary Law 1049/08) and the modeling of the state system of technology parks. The latter also involved a significant contribution from Carlos Américo Pacheco, alongside whom I now have the satisfaction of sitting on FAPESP's Executive Board.

In 2005, still as undersecretary, I followed Brito's move to take on the mission of being FAPESP's new Scientific Director. Shortly thereafter, in 2007, I began working with him more directly since I became an advisor to the Presidency of FAPESP, then occupied by the Ambassador and former Minister of Foreign Affairs Celso Lafer (2007-2015), who was succeeded by the former Minister of Education José Goldemberg (2015-2018). My relationship with Brito intensified when, in May 2017, I took over as Chief Administrative Officer from my dear friend Joaquim de Camargo Engler.

Fernando Menezes, CAO

I have known Brito since 1975, when I started studying at the Aeronautical Technology Institute (ITA). Brito had been admitted there a year before. His company was always very gratifying. I greatly appreciated his intelligence, perspicacity, strong critical sense, fine irony and sense

of humor. As undergraduates, we shared responsibility for running the course that prepared low-income candidates for the admission exam, as well as the film club and some student union activities. Later on, at UNICAMP, Brito had an admirable career that led to his becoming Rector with significant support from the academic community. At that time, I was at the Ministry of Science and Technology, where he helped me with ideas and criticism. When I returned, I kept track of his initiatives, such as establishing UNICAMP's Innovation Agency, among many others. In setting up the São Paulo State Technology Park System, as Rector of ITA and later as the head of the National Center for Research in Energy and Materials (CNPEM), I was always able to rely on his knowledge and wise counsel to improve what we were doing. We began working side by side on an almost daily basis when I became the CEO of FAPESP in 2016, with Joaquim Engler and, later, with Fernando Menezes as CAO. It has been a pleasure to do so and to be his friend.

Carlos Américo Pacheco, CEO

GREAT PARTNERS WORLDWIDE

Brazilian Ministry of Foreign Affairs

National Science Foundation (NSF)

UK Research and Innovation (UKRI)

German Research Foundation (DFG)

European Union (EU)

Netherlands Organisation for Scientific Research (NWO)

UK: British Embassy, Newton Fund
and British Consulate General

UK: Biotechnology and Biological Sciences
Research Council (BBSRC/UKRI)

National Research Council (CONICET), Argentina

National Research Foundation of South Africa (NRF)

Social Sciences and Humanities
Research Council of Canada (SSHRC)

Brazilian National Council of State Funding Agencies (CONFAP)

Brazilian Ministry of Foreign Affairs

BRITO CRUZ, INNOVATION DIPLOMAT

Ademar Seabra
Diplomat, former head of DCTEC Division, Ministry of Foreign Affairs, Brazil; PhD, Social Sciences, USP; MsC in Philosophy, Logic and Scientific Method, LSE; MsC in Political Science, UnB; author of "Diplomacy, Development and National Innovation Systems" (Brasília, FUNAG, 2011) and of "Justice as Fairness" (Rio de Janeiro, Lumen Juris, 2004).

Achilles Zaluar
Ambassador, Director of the Department for Technological Promotion (DCT), Ministry of Foreign Affairs, Brazil; BSc in Mathematics, PUC-RJ; Master in Public Administration (MPA-MC), Harbard Kennedy School.

When we were invited to write this laudation to Professor Carlos Henrique de Brito Cruz, we were struck by the news that he was leaving the scientific directorship of FAPESP, after 15 years of relentless work promoting ST&I in São Paulo and throughout Brazil. While it is commonly said no one is irreplaceable, it is also very much true that Brito is the professional and humanist who seems as if he could disprove this notion. His substitute, however, will have the advantage of standing, as it were, on the shoulders of a giant.

It was from Brito's vantage point at Alto da Lapa that he either oversaw, implemented, constructively criticized or formulated policies for Brazil's scientific and technological development. Dealing daily with pressing issues, he was able to connect those challenges to the wider strategic

challenges of Brazil's socioeconomic development. He discovered paths for Brazil's competitive insertion in the global economy and in the group of innovative centers of the Fourth Industrial Revolution.

Few scientists and scholars in the area of ST&I understood, with similar clarity, the necessity of joint action among the diverse parts of the Brazilian system for science, technology and innovation. He has always been a relentless fighter against the lack of teamwork that sometimes hinders Brazil's path towards becoming a fully developed and innovative country.

Few have striven with such passion to articulate the societal impact of science with the needs of economic growth. He championed the vision that our industry and service sectors must partner with our scientific and technological capabilities in order to boost innovation, internationalization and competitiveness. He has been a champion of the causes of innovation and of the much wider participation of tech and knowledge-intensive sectors in Brazil's economic output, exports, and development strategies.

For those who have been lucky enough to attend Brito's speeches and read his articles and essays, it is with admiration and ease that we see him delving into concepts, problems and ideas belonging to areas as diverse as biomedicine and health, renewable energies, avionics and aeronautics, environmental studies and applied physics (his more formal area of research, at his alma mater, the Institute of Physics Gleb Wataghin of the University of Campinas).

In his many lectures, speeches, interviews and supervisions, in São Paulo, in Brazil and in many other countries, Brito operates the synthesis between scientific rigor and the promotion of the Brazilian national interest. He has promoted the inventiveness of Brazilian scientists, technicians and entrepreneurs, in developing programs such as the bioethanol; praised the global impact of Brazilian health research in fighting cancer, in producing vaccines and in curbing the spread of

infections such as the HIV; explained why state-of-the-art science has made EMBRAER a leading airplane developer and manufacturer; and demonstrated the impact of Brazil's agricultural research in the world.

Brito is a frontline defender of Brazilian science, Brazilian universities and Brazilian professors, scientists, academics and researchers, who often face challenging working conditions but nevertheless bring outstanding achievements to Brazilian society. He can be versatile when it is needed, and a specialist without ever being arid. He is a civil servant who is a scientist and a researcher fully dedicated to the overcoming of the challenges of Brazil's development. Brito sees science not as an end in itself, but as a tool for the progress of mankind and, specially, of Brazil.

Brito belongs to the intellectual family of science's best pioneers. They have in common the telos proposed by Francis Bacon: "Science discovery should be driven not just by the quest for intellectual enlightenment, but also for the relief of man's estate". A notable aspect of Brito's personality is his determination to connect science to humanistic values. His work in institutions such as FAPESP, the Brazilian Academy of Sciences, the Brazilian Society for the Advancement of Science, AAAS, the Royal Society and others has been directed towards harnessing the impact of science with the principles of ethics and the values of pluralism, freedom and human advancement.

In one of Brito's presentations, after he presented FAPESP's rigorous academic assessment principles, one of us jokingly asked him the question of whether the Foundation would patent the results of research that categorically demonstrated God's existence. With his usual wit, Brito replied with a reference to who should always be the ultimate beneficiary of science: "On the opposite, such an extraordinary discovery would be immediately released, for the good of humankind."

If excellence and social benefit are to be the hallmarks of Brazilian scientific output, we have to raise the bar for financing projects in all the areas in which we still lag behind. This tightening of standards coincided

with the initial years of Brito Cruz as scientific director of FAPESP. He consistently applied to Brazil the top parameters of scientific assessment, on a par with leading OECD countries. In Brito's practice, "best science" and "state-of-the-art knowledge" are not the privilege of a few countries, but stem from the collective efforts of the worldwide community of researchers and scientists, in which the Brazilian community is able to play an important role.

Brito pioneered a more radical transformation, not only of FAPESP, but also of the parameters through which Brazilian science is assessed and promoted. He was not comfortable waiting for the germination of the seeds he sowed in the half-fertile, half-arid soil of Brazilian technological development. Looking outward, he envisaged productive international partnerships that would irrigate Brazilian innovation.

Better access to scientific knowledge is hindered, moreover, by the escalating costs of scientific infrastructure; by the ever-longer effort required for developing new technologies; by more stringent intellectual property rules; and by the virtual impossibility of doing science alone or in small groups, as had been the rule until a few decades ago. It became indispensable to take full part of rapid, global exchange of knowledge and research.

All this was clearly perceived by Brito and, at the beginning of the 21st century, a bold program of internationalization of the science of São Paulo was put under way. It consisted of partnerships for research and innovation which promote stronger ties with leading scientific powers such as the United Kingdom, the United States, France, Japan, Sweden, Germany and Canada, among many others. Those partnerships, such as the programs "Frontiers of Science" with the UK and Chile, promoted mobility, joint research, a surge in co-authorships and the involvement of foreign scientists and academics in the assessment of programs and calls for projects in FAPESP itself.

This resulted in an unprecedented raising of standards for scientific

research in São Paulo, soon accompanied by other state funding agencies and by the Federal Government itself. Since then, co-authorship increased so much that more than a third of all indexed scientific articles published by Brazilian researchers have international co-authors, hailing from more than 200 countries. Brazil – with São Paulo leading the way - improved its relative position in the worldwide ranking of indexed bibliometrics. There has been an upsurge in calls for tenders for international partnerships in innovation.

Brito put his talent and enthusiasm in the creation of the Advanced School for Innovation Diplomacy, sponsored by FAPESP. He supported the introduction of many academic and graduate programs in English at the public University system of São Paulo. And he led the strengthening of scholarships programs and projects abroad, in spite of severe fiscal constraints and an unfavorable exchange rate.

Brito soon embraced the concept of innovation diplomacy ("Diplomacia da Inovação", a concept that also adopted at the Brazilian Foreign Ministry). He was convinced, and then he convinced others, of the need to catch up with the leading scientific centers through partnerships among national and foreign scientific and academic agencies, investors, entrepreneurs and researchers. This is being accomplished through incentives for the participation of foreign partners into the Brazilian system and of Brazilian researchers into projects abroad; through the mobilization of Brazilian scientists, researchers and entrepreneurs living abroad (the Brazilian ST&I diaspora); and through the expansion of international scholarship programs for researchers from Brazilian universities and R&D centers.

FAPESP has become an example for the internationalization of ST&I in Brazil and at the center of it lies the figure of the extraordinarily talented scientist, civil servant, scholar and science popularizer Carlos Henrique de Brito Cruz. Although, unlike his Ambassador brother, he is not formally a member of the Brazilian Foreign Service, he became

one of Brazil's greatest innovation diplomats. He conciliates a healthy patriotism, a carioca good humor blended with a a paulista earnestness, and the worldview of an internationalist. He is the model of the humble scholar, admired by peers from all fields of knowledge, from all parts of Brazil and throughout the world.

The partnership between FAPESP, the Brazilian Foreign Ministry (MRE), the Ministry for Science, Technology, Innovation and Communications (MCTIC) and all the multiple other players of the Brazilian system for science, technology and innovation knows no greater champion than Brito. We look forward to keep working with him at the service of the two causes to which he dedicates his career: Brazil and science.

National Science Foundation (NSF)

CONNECTIVITY AS LEGACY: CELEBRATION AND GRATITUDE FOR DR. BRITO CRUZ

France Córdova, Director

Every scientist begins a Festschrift the same way we begin all important things in life, with research.[1] That means many Festschrifts begin with a Google search on how to write a meaning Festschrift. At least, this one did. From there, it proceeded to a search on our illustrious subject: Dr. Carlos Henrique de Brito Cruz. And in less than one second, Google returned 21 million results – 21 million[2]. This is worth mentioning because in those results – pages, citations, references, reports, quotes – it is clear Brito Cruz has gifted us an irreplaceable web of connectivity.

The world knows and benefits from Brazil's science and technological prominence thanks to Brito Cruz. São Paulo makes outsized contributions to Brazil in terms of GNP, PhDs, and international scientific publications thanks to Brito Cruz. And São Paulo Research Foundation (FAPESP) together with the National Science Foundation (NSF) enjoys the fruits of deep-rooted partnership thanks to Brito Cruz.

While FAPESP supports all fields of science, programs in Biodiversity, Bioengineering, Global Climate Change, and e-Science are especially noteworthy. On a rapidly changing planet, the decade's long

1 And at least one footnote to prove it.

2 This is at least ten million more returns than the Google search for Festschrift as conducted on at least one computer in Alexandria, Virginia in the year 2020.

partnership with FAPESP on the NSF Biodiversity Program is vital. We've worked together to understanding biodiversity – the connectivity of life in the rising sun, flowering plant, Amazon River flowing. In short, our work together has contributed to understanding biodiversity as the intricate web sustaining human life.

And as we work to understand matters on the phylogenic order, race to capture what is vanishing, study methods of resiliency and modes of adaptation – sustainability and yield – we confront the dual needs of environment and economic development. Brito Cruz has helped champion sustainable economic development through scientific progress. These are no small challenges and it is with no small courage and determination that Brito Cruz has worked through partnership and collaboration, including the NSF Engineering Research Center-to-Center program, bringing together two major engineering efforts in Brazil and the U.S. to address topics on Energy and Environment.

And just as the study of biodiversity is a convergence of many threads, so are these connections among research foundations. It takes leadership to build. And for his dedication to building collaborations, building scientific progress, Brito Cruz is a leader. May the next generation honor his contributions by taking them further.

For strengthening our understanding of the web that is biodiversity, for creating connections among international scientific communities, for strengthening Brazil's investment in basic research to resounding positive effect, we commend Brito Cruz. It was delightful to see Brito Cruz in São Paulo last May 2019 as FAPESP successfully co-hosted the Global Research Council. I hope our paths cross again soon. Until then, as he begins this next chapter, may his scientific diligence, compassion, and curiosity for understanding guide him. On behalf of the National Science Foundation, we wish Brito Cruz well and give him our sincerest thanks.

UK Research and Innovation (UKRI)

Sir Mark Walport, Chief Executive

Dear Carlos,

It has been a great pleasure to work with you over the years and to get to know you personally.

Before you step down from FAPESP, I'd like to take this opportunity to thank you for your efforts and enthusiasm to champion research and innovation collaborations with the UK and between FAPESP and UKRI.

The scientific links between our countries have grown significantly under your direction, and the award of an OBE for your contributions to science and public service in 2015 was well-deserved.

With your support, and thanks to programmes such as the Newton Fund, the UK has risen up the rankings over the past 10 years to become FAPESP's top European partner.

The past two years have been important for both of our organisations. I'm very pleased that UKRI was associated with the celebrations of the UK-Brazil Year of Science and Innovation 2018-2019 and participated in the FAPESP Week in London in the beginning of 2019. We also updated our UKRI-FAPESP Operational Guidance and hosted a Brazilian ministerial visit to the UK in April 2019. I was delighted to meet you in the UK just before Christmas last year when you were a judge at the Queen Elizabeth Prize for Engineering.

The FAPESP-UK events in São Paulo this week recognise your huge contributions to science, research and innovation and celebrate your legacy for FAPESP and our strong relationship in science and innovation.

Alongside our UKRI representatives at the event, Michael Booth and Tim Willis, as well as those participating in the Newton Fund staff exchange, I understand that the UK is represented at very high level at this event, including the British Ambassador to Brazil, Vijay Rangarajan, who has been a strong advocate of research and innovation between the two countries, Lisa Weedon, the new British Consul in Sao Paulo, and Professor Carole Mundell, the FCO's Chief Scientific Adviser. This shows how our two countries are committed to the research agenda today and in years to come.

In the context of the Global Research Council, we'd like to thank you for hosting the 2019 Annual Meeting of the Global Research Council, which provided an open forum for discussion of strategic issues for GRC and research organisations worldwide. Since May 2019 you have been an engaged chairman of the GRC Governing Board and have made excellent contributions to discussions about GRC's vision and strategic priorities for the next decade.

We're also grateful for FAPESP's continued engagement and representation in GRC statutory groups and related activities, including Professor Euclides Mesquita Neto's support to the GRC Executive Support Group (ESG) and the continuous input of Dr Ana Maria Almeida to the Gender Working Group, together with support from Carolina Costa throughout the years.

UKRI enjoys close and personal ties with FAPESP and we want to ensure that collaborations with Brazil, and FAPESP in particular, remain strong with your successor, Dr Luiz Mello.

We will take steps to build a strong relationship with Dr Luiz Mello and would welcome an opportunity for him to visit the UK to meet stakeholders, better understand the UK research and innovation landscape and explore future opportunities for collaboration.

Once again, thank you for your outstanding leadership of FAPESP and very best wishes for the future.

All the best,
Mark

German Research Foundation (DFG)

Peter Strohschneider, President

Dear Brito,

I would like to thank you very much for the many years of such good friendship and productive cooperation, which I would like to describe as sustainable in the best sense of the word. Already at the very beginning of your first term as Scientific Director of FAPESP, you were involved in setting up the cooperation agreement between DFG and FAPESP in the year 2006.

Academic cooperation between Germany and Brazil has evidently been growing during the last years and Brazil has become a strategic partner for the DFG in Latin America. Following this prospering development in the research cooperation between both countries, DFG opened its Latin America Office in São Paulo in 2011 within the German House of Science and Innovation. With this strong anchor in São Paulo next to FAPESP, DFG has intensified the research cooperation with Latin American countries. This development would not have been possible without the strong partnership of FAPESP. I would like to express my great gratitude for making this exceptionally trustful cooperation possible for many years.

Bilateral cooperation between the DFG and FAPESP has developed so positive under your guidance, with many jointly funded projects from different disciplines, such as the German-Brazilian Research Training Group in the field of complex networks, which brought together principal investigators and doctoral students

from both countries in the areas of physics, mathematics, biology, climatology and geography over many years.

Allow me also to thank you for your research-oriented, strategic, and integrating engagement within the cooperation at the global level. I would like to take this opportunity to mention in particular your commitment in international forums such as the Global Research Council, especially during the *Annual Meeting 2019* in São Paulo. Although FAPESP as research funding organization is responsible strictly for the state of São Paulo, Brazil as a whole has gained a strong and differentiating voice through your involvement in the Global Research Council. I do very much hope that FAPESP will further play a strong and strategic role on the global level.

We are living in times of global advancement of the sciences and humanities, of technology, and digitalization. Not least in São Paulo one can recognize that development and innovation driven by scientific and scholarly endeavors are key factors for economic prosperity and social welfare. The State of São Paulo shows a very strong focus on the academic sector with excellent universities and research institutions, resulting not only in economic and social success, but particularly in creating new knowledge with an impressive number of excellent scientific and scholarly publications and in the systematic training of young researchers – increasing year by year. This successful development is largely due to your consistent commitment to facilitate a free and consequently quality-oriented and criteria-based research funding system within FAPESP.

Please allow me to reflect here on the motto of the workshop "Collaborative Research on the Sustainable Development Agenda", to be held to honor your 15-year tenure as the Scientific Director of FAPESP, and which I am unfortunately unable to attend. There

exist complex challenges where it is difficult to split the research processing in the typical pattern of "problem" and "solution". We can illustrate the latter with the example of the so-called grand challenges, such as climate change, the major widespread diseases or demographic changes – all questions, which are tackled within the sustainable development agenda. What is it that determines the "size" of these challenges? It is hardly their global dimension alone. Rather, these challenges are "great", even too great, in the sense that they cannot be researched as such. They cross all disciplinary boundaries a priori. Climate change only can become an object of research by being deconstructed into countless and often extremely specialized research questions in the natural, social and economic sciences, but also in the cultural sciences and humanities. It is far too complex for being scientifically treated simply in the scheme of "problem" and "solution". From this consideration I would conclude: the greater and the more pressing societal challenges become, the more important it is not to rely exclusively on the "old new" in science – as important as the targeted search for solutions may be, which are determined by the already known problems. However, we must in addition also focus on the "new new": on pushing forward the frontiers of the conceivable, on the emphatically innovative. We must also seek answers that are not already determined by the questions, which already were marked out.

We are facing more and more such complex research challenges and at the same time, we recognize an increasing tendency of politicians to provide easy answers to difficult questions in order to win popular vote. This behavior can threaten a healthy relationship between the research system and society at large. Populist and autocratic politicians take science and research as an object of

insinuation. They massively spread distrust towards the experts while deliberately hindering an open exchange of arguments, which has been the standard in liberal societies. And what this would leave behind would be an order of 'alternative facts'. In such an order, validity would not derive from truth but from power. To be certain, the problem with alternative facts is not that others interpret information differently than we do. This is the pluralism of modernity. Nor is the problem that a president's "war against the media" would obscure the distinction between truth and lies. On the contrary, this distinction is always presupposed; otherwise, the talk of 'fake news' would be impossible. The idea of a 'post-truth era' therefore is misleading. And it is dangerous as well: It makes something deliberative look natural. More so, it does not disclose the fact that terms like 'fake news' and 'alternative facts' are causing a substantial political shift: Instead of referring to an objective world as a legitimate source of understanding, populists and autocrats define the reference to power as the only legitimate source of understanding. Truth becomes a function of power. It asserts, that those, who own power and those, who follow them, even own the truth. All the others are liars.

Despite such complex challenges, it is good to know that research and academic exchange will never stop at the borders of countries and continents. And it is obvious that scientific and scholarly internationalization and globalization will further increase. Mobility and cooperation – across disciplinary and across national borders alike – have become essential assets. We both share this conviction. DFG has done a step across the borders to Brazil, and will stay there, even during 'complex' political times.

I am grateful for the interest, support, and great hospitality we

always have received from you and your colleagues at FAPESP. I remember very fondly the stimulating meetings with you in São Paulo, in the beautiful conference room at FAPESP, which always were marked by great trust and consensus. I wish you all the best for further professional activities, should you continue to pursue them, and of course personally all the best for you and your family.

Should you plan to visit Germany during one of your next trips, I would be delighted about to meeting you there.

Best wishes,
Peter Strohschneider

European Union (EU)

Ignacio Ybáñez, Ambassador and
Alejandro Zurita, Minister Counsellor ST&I

Dear Carlos or better said dear Brito,

We learned that here in Brazil, all people call you as Brito, also the way you sign your messages. Let us first refer to your well-known scientific career as researcher, Full Professor, Rector of UNICAMP, president and scientific director of the São Paulo Research Support Foundation (FAPESP), among several other international activities and distinctions.

Since our first contacts, we were impressed to confirm the weight of FAPESP in science, technology and innovation (STI), and in particular to learn the principles that you are applying when managing the international cooperation of the Foundation, aimed to emphasise the relevant and active role that Brazilian researchers and entities should play in whatever competitive international collaboration they will take part. Your direction is focussed to make São Paulo a widely international reference as research hub and to demonstrate with concrete deliveries the importance of FAPESP in the global STI arena.

In this respect, your work as Scientific Director bringing FAPESP to play an international role is widely acknowledged. And this is also reflected in your nomination in May 2019 as Chair of the Governing Board of the Global Research Council (GRC), the association of the heads of the world's leading research funding agencies, which includes the European Commission.

Indeed, the Directorate General of Research and Innovation (R&I) of the European Commission is also acting as research funding body of the European Union (EU) and is also managing the STI cooperation between the EU and Brazil. And this is mainly implemented by means of EU programmes for R&I, Horizon 2020 and Horizon Europe starting in 2021. That bilateral STI cooperation is also framed under two governmental BR-EU Cooperation Agreements in force respectively on S&T and on Fusion energy research, representing STI in that way a very strong pillar of the 2007 Brazil-EU Partnership Agreement.

In this framework, the European Commission is also working with FAPESP in several bilateral and multilateral domains. In particular the Letter of Intent signed in March 2015 between the EU Delegation in Brazil and FAPESP should be remarked. It was launched in line with the Letter of Intent signed also with the National Council of State Funding Agencies (CONFAP), under which we have also perceived very fruitful exchanges and interactions. Indeed, FAPESP's guidelines is aimed to implement mechanisms for co-funding the Brazilian participation in collaborative Horizon 2020 projects, and became an excellent example also encouraging various Research Support Foundations of other Brazilian States to publish specific guidelines.

Furthermore, several specific projects under the frame of Horizon 2020 and the European Research Council, programmes and agreements under EU-LIFE, Eureka Network, Belmont Forum, ERA-Net and the Trans-Atlantic Platform for the Social Sciences and Humanities should be also mentioned.

In this regard, several events were co-organised by FAPESP and the European Commission with great satisfaction to interact with

you from high level representatives of the European Commission. Let us notably refer just to the EU Commissioner of R&I Carlos Moedas, the Deputy Director General of R&I Signe Ratso, the Director of R&I International Cooperation Cristina Russo, and the President of the European Research Council Pierre Bourguignon, among others.

It has been an honour to work with you under FAPESP, as well as with your team, which we highly appreciated for all the collaboration and support, specifically from Prof Marilda Bottesi and Ms Virginia Subiñas. The European Commission remains available for further interactions and collaborations with you also to better comprehend the Brazilian STI system, its challenges and potentialities. We wish you all the best in the future and hope to continue our excellent and fruitful cooperation.

Ignacio Ybáñez and Alejandro Zurita

Netherlands Organisation for Scientific Research (NWO)

A BRIEF HISTORY OF THE FAPESP-NWO PARTNERSHIP; A PERSONAL PERSPECTIVE

Stan Gielen, Chairman

Fifteen years being the scientific director of FAPESP means an amazing fifteen years of shaping the science policy in the state of São Paulo. This is reflected not in the least in its international prestige. Generally speaking we, NWO, have been looking to São Paulo and FAPESP for several reasons: obviously the very high concentration of excellent science; the research culture that is similar enough for easy collaboration and dissimilar enough for cross fertilisation; our joint commitment to the Global Sustainability Goals and of course access to a pool of highly talented researchers and students which are greatly valued at universities in the Netherlands. All of these, prof. Brito has helped shape.

The formal collaboration with NWO started halfway of prof. Brito's tenure as FAPESP's scientific director, in the wake of the Dutch royal visit to Brazil in 2012. From the start and ever since, FAPESP has been a most valued and trusted partner even through the turbulent years of the economic crisis. I, myself have witnessed the fast developments in Brazil in the past 15 years. First as dean of the Faculty of Science of Radboud University in The Netherlands, where the faculty of Science accepted about ten students from Brazil every year. Later on, these past three years, as chairman of NWO. These latter years, I have also become personally

acquainted with prof. Brito and his views on science in a few brief, yet pleasant conversations at GRC meetings. Being both physicists, I believe we shared many views on science and strategies to promote science.

When asking around with people that have had a longer history with prof. Brito, the same characterisation kept popping up: in a pleasant and easy going manner, prof. Brito is focussed on efficiency in procedures and excellence in research. In practise this translates to a very low threshold for collaboration, with only two main criteria: Research proposals should be real collaborations with all parties contributing equally in terms of intellectual effort, and funding criteria should not impair research excellence. This attitude has been immensely helpful in our history of joint collaboration.

These past eight years, the Netherlands have been a modest partner in terms of budget. However, the quality of our research collaboration has been very high. In my opinion, this is due to the choice of topics for impactful collaboration which consistently allow the best researchers in the state of São Paulo to collaborate with the best researchers in the Netherlands. The flexibility of prof. Brito's policies allowed us to investigate what the universities in the Netherlands consider their priorities for collaboration with universities in São Paulo and then simply align these with FAPESP and their criteria of equality and research excellence.

The staple of our collaboration has been the annual joint FAPESP-NWO programme, which started with the topic of bio-based economy in 2013 and which, when we revisit the topic of bio-based economy this year, will come full circle. In this joint programming, we have gotten to know each other and each other's modalities for research funding more closely. There has been ample room for experimenting as well. For example, we have experimented with multi-lateral programmes together with the UK's ESRC on the topic of "sustainable urban development" (2014), with "big science" in the programme for "advanced instrumentation for astronomy" (2015) and with public-private partnerships and the inclusion

of compulsory private cofunding in the programme for "data-driven research for sport and healthy living" (2016). The topics of "biobased economy" (2017), "ecosystem restauration" (2018) and "healthy ageing" (2019) complete the overview of our previous collaborations.

The flexibility of prof. Brito's policies also allowed us to map out some strategic topics (namely "Knowledge of Nature and Natural Resources" and "Knowledge for Health, Healthcare and Vitality") on which to intensify our collaboration in the coming years and of which we expect much. These topics are intended to maximise the potential for aligning scientific, social and economic interests together with the support of government and industry both in the Netherlands and in the state of São Paulo.

Importantly, during all this experimenting, we have learned to appreciate the similar objectives of each other as funding agencies, for example with respect to open science (which is close to my heart personally). I was pleasantly surprised when FAPESP asked me whether they could use the guidelines for Research Data Management, which were developed by NWO and which were adopted as "good practise" by Science Europe and the European Commission for the new Horizon Europe programme. We have therefore been looking for ways to intensify our collaboration beyond the limits of an annual joint programme. In this, prof. Brito has always been a strong advocate for opening up all our funding modalities to bilateral cooperation. Recently we have made a major stride towards this end, in opening the NWO instruments to the world by inclusion of a module called "money follows collaboration". This module, which can be appended to each of the NWO instruments, allows us to pay for bilateral cooperation under some lenient conditions which echo prof. Brito's main criteria of equitable collaboration and research excellence.

With prof. Luiz Eugênio Mello as new scientific director at FAPESP, we have little doubt that we will be able to continue the close and warm

collaboration between our organisations. On a personal note, however, I will be sad to lose the fraternity of a fellow physicist. The internet tells me that, as young as I am, prof. Brito is even four years younger. Clearly, we are both far too young to retire and I am therefore confident that we will meet again professionally. I will be looking forward to the moment of that happening, because I am sure that we can find a way to continue our collaboration in the same spirit of equality and excellence.

I wish to conclude by thanking prof. Brito for all that he has meant for the NWO-FAPESP collaboration, and to wish him all the best in his future endeavours.

Saudações cordiais.

UK: British Embassy, Newton Fund and British Consulate General

BY HMA TO BRAZIL

It is my pleasure to contribute a message of thanks and farewell to Professor Brito on behalf of the British Government. Although I have only had the pleasure of knowing Brito for the last few years, he has been a longstanding partner and friend of the British Embassy for nearly 15 years. During that period, we have shared some significant milestones that have shaped, deepened and consolidated the remarkable partnership that the UK and FAPESP now enjoys.

Early in his role as Scientific Director, around 2007, the UK launched its new Science and Innovation Network, with Brazil selected as one of the priority countries for science collaboration. As the Embassy science team set out to build new partnerships between the UK and Brazil, they found an early friend and mentor in Professor Brito. His support and enthusiasm was fundamental to developing early links between UK and São Paulo research institutions, universities and researchers.

In 2009, FAPESP signed an agreement with Research Councils UK (RCUK), now restructured and relaunched as UKRI (UK Research and Innovation). The agreement created an important shared platform for the assessment and funding of joint research, that has opened new opportunities for thousands of our researchers. FAPESP's partnership with UKRI and our growing researcher links, meant that we were ideally placed to take full advantage of the new opportunities offered by the Newton Fund, when it launched in 2014. The Newton Fund continues to be an important tool for UK/FAPESP research collaboration.

In 2015, Professor Brito was awarded an OBE by Her Majesty Queen Elizabeth II, in recognition of his personal contribution to promoting science collaboration between the UK and Brazil. This is one of the highest honours the UK can bestow on international partners. It was well deserved.

Under Brito's guiding hand, FAPESP now has agreements with organisations and universities across the UK, from Edinburgh to Southampton, and from East Anglia to Bangor. With UK Research Councils, the British Council, private companies and research institutions. Developing these agreements and the relationships behind them takes time and energy. Thank you Brito. You have been instrumental in making things happen. With your help, FAPESP is now one of the UK's top science partners. Together we have advanced the science on global challenges such as infectious and neglected diseases, water supply, clean energy and urban transformation, changing the lives of our citizens for the better.

Professor Brito, you leave behind a formidable legacy. Count on us to continue your good work. We look forward to keeping in touch. *Nossa casa é sua casa.*

Vijay Rangarajan
British Embassy

I have had the pleasure of interacting with Prof Brito on a series of UK and FAPESP initiatives, and I have a vivid memory of a specific episode in working with him. I was representing the Science and Innovation Network in the first FAPESP week in London, in 2014, and was in charge of accompanying the UK Minister for Science at the time, the Rt Hon. David Willets, to ensure his attendance on the opening table

of the event. All the high-level guests were already seated and ready to initiative their speeches when Prof Brito came suddenly to me and asked: how to best address the Minister, what does the acronym The Rt Hon. mean? I was fairly new to the job and the Anglophone prefix to show honour was also a novelty. I did not have an immediate response as he would have liked, so I run and reached the Minister's personal assistant that with a peculiar look said to me that Rt. Hon meant The Right Honorable! Prof Brito was briefed and the first FAPESP Week in London commenced.

I also remember the joint evaluation panel between the FAPs and the UKRI to assess the research projects from the very first Newton Fund call in Brazil. Looking back, it was probably a very ambition endeavour, there were too many organizations involved and too little time for pulling all together. There were definitely challenges in running the evaluation panels and I recall sending emails to Prof Brito in the middle of the night asking his support to pacify some of the issues and to guide the representative of FAPESP at the panel.

I have been the manager of Newton Fund responsible for the engagement with State Funding Agencies since its launch in 2014. FAPESP has been the most active partner of Newton Fund adhering all the joint calls and immensely contributing to the success of the activities launched in Brazil. We have launched together over 26 joint calls and I am specially thankful for his support on bold initiatives such as the multilateral calls on scientific workshop and also the leadership of FAPESP in the Newton Fund regional call on Biodiversity with Mexico, Peru, Chile, Argentina and of course the State of São Paulo.

Over the past 10 years working for the Science and Innovation Network I have witnessed Brito's enthusiasm and vigour in strengthening the scientific and innovation cooperation with the UK and ensuring that researchers from the State of São Paulo, and to some extent from Brazil, are provided with the best opportunities to carry out

state-of-art research. He has definitely taken the collaborating with the UK to another level and has left a robust and positive legacy with UK science partners.

I have felt privileged to be part of this joint effort and I am very grateful to Professor Brito partnership and his support on implementing Newton Fund. I wish you the best of luck in your new endeavour.

Diego Arruda
Newton Fund Manager, Science and Innovation Network

I first met Prof. Brito in the launch of the UK - Brazil Year of Science back in 2007 which was the Science and Innovation Network first big project in Brazil. The project resulted from Sir David King's desire to see an increase on science collaboration between Brazil and the UK. Sir David came to Brazil for the launch ceremony in the British Consulate building in São Paulo accompanied by a delegation of UK scientists. The Science team was new to the job and led by a former RCUK member with little understanding on the Brazilian Science landscape but with lots of ideas and enthusiasm.

FAPESP never confirmed Prof. Brito presence in the event and we weren't expecting him. When I saw him arriving at reception I run after him to guide him into the event hoping he didn't notice how surprised we were to see him there. In the backstage we were running to squeeze an extra chair in the top table, looking for printers for new name signs, reviewing sitting plans in time of the opening. I still wonder if he noticed that we were all over the place... from such a messy start it is amazing to see how the partnership between us flourished. I do admire Prof. Brito's way of working and his ability to turn new opportunities into a stronger and more meaningful ones. This is how the FAPESP - RCUK agreement

was possible which to this day is incredible to think that all 7 UK Research Councils agreed to sign a single agreement and now after 10 years it is a well-established research funding source.

I also remember UK Science Minister David Willetts visit to Brazil. It was a particularly challenging visit to organise when our team was under a restructuring process and a lot of pressure. As ministerial visits usually are with endless last minute changes, I had to keep asking Prof. Brito to make changes in the agenda. Not sure many people would agree but I thought he was Very patient and I am forever grateful for his support in delivering a great meeting with the Minister at the São Paulo State Government. Not to mention it was one of numerous high level meetings we organised with FAPESP.

The UK recognises and value the importance of Prof. Brito contribution to strengthen the collaboration with the UK and awarded him with an OBE (Order of the British Empire). I now meet Prof. Brito in events where he comes to tell me that he is invited by the Queen to receptions in Buckingham Palace! I work for the Queen for almost 15 years and I never saw a shadow of her! This is really remarkable and priceless.

I have only to thank Prof. Brito for the partnership and for believing in our work. I have fond memories from great initiatives we had and wish you a bright and special future.

Cristina Hori
Science and Innovation Manager

Biotechnology and Biological Sciences Research Council (BBSRC/UKRI)

Melanie Welham, Executive Chair and
Tim Willis, Associate Director International

Dear Brito,

We are writing to confirm our thanks to you for your commitment and success in making BBSRC a favoured partner in FAPESP. It is with sadness we hear you are leaving your post, but we also note and congratulate you on your legacy of sustained and successful partnership with BBSRC and now with UKRI.

BBSRC interactions with FAPESP stretch almost the entire duration of your tenure as Scientific Director: from our first BBSRC-FAPESP Bioenergy Workshop in March 2008 (and a joint BBSRC-FAPESP call in advanced biofuels) up to the present joint programme on pathogens of crops and livestock, we have together led FAPESP-UKRI collaborations. But our joint success lies not just in programmes to fund joint projects: we have together pioneered mechanisms for collaboration from Virtual Joint Centres (in agricultural nitrogen) through to BBSRC's (and then RCUK's) first open Lead Agency agreement (18 joint projects with BBSRC: by far the highest within UKRI), under which our first joint grant on enzyme discovery started in February 2012, and our unique pump-priming awards which started the same year (8 awards to date).

Under your direction, FAPESP's flexibility in approach, and dedicated commitment to excellence, has ensured the joint research and activities we have co-funded address many Sustainable

Development Goals through co-investments which are now showing impact on the economy (through biorefinery approaches and the manufacture of advanced biofuels), agriculture and food security (agricultural nitrogen, AMR and pest resistance in agriculture; pathogens in crops and livestock) and of course mutual capacity building and training of early career researchers.

BBSRC launched our Brazil Partnering Award Scheme in 2011 and since then we have invested over £1.15M in 28 partnerships, of which 16 are with institutions in the State of São Paulo.

This plot shows UK-Brazil linkages with BBSRC investment, and it clearly shows the significance of our interactions with São Paulo State institutions, co-funded with FAPESP (33 connections alone with the University of São Paulo).

You have established FAPESP as the major global partner for Brazil in bilateral UK-Brazil and multinational research funding, through commitment to partnering with the UK; a visionary approach to joint working and practical application throughout, FAPESP ensuring effective implementation at official level of UK-FAPESP activities, of huge benefit to the UK bioscience community.

Your achievements have also been recognised through a well-deserved honorary OBE awarded to you in 2015.

The State of São Paulo is currently the second most frequent collaborator in BBSRC investments, led by the US.

We have enjoyed many occasions to celebrate FAPESP – BSBRC-UKRI successes through FAPESP weeks in London in 2013 and again in 2019, when our Ministers meet in formal missions and through our UK Government Chief Scientific Advisor activities. Tim looks forward to representing BSBRC at your event in March, and we look forward to celebrating future success based on the extensive legacy you leave with us.

With all best wishes for the future,
Melanie Welham and Tim Willis

National Research Council (CONICET)
Argentina

THE IMPACT OF THE SÃO PAULO RESEARCH FOUNDATION IN THE REGION AND ON BILATERAL COOPERATION WITH ARGENTINA

Jorge G. Tezon

FAPESP Researchers in Argentina and Brazil have actively collaborated over many years. This association, evidenced in joint publications, found institutional support with the signing of agreements between CONICET and the National Council for Scientific and Technological Development CNPq. However, this collaboration took greater moment with the conclusion of our agreement between CONICET and FAPESP in 2010.

With no other counterpart, we have had such demand for joint projects as with FAPESP. Since then and through several calls, the two institutions have funded 46 biennial projects in wide-ranging areas such as agriculture sciences, Engineering, Medical sciences, Biology, Earth sciences, Astronomy and Chemistry. With this experience CONICET and FAPESP agreed on a call in 2019 for new projects focused on topics such as ecosystem services; Oceanography; Materials science; Food safety; Big data; Public health and collective health; Human rights, minorities and gender; Demography and Migrations; Social and political organization.

CONICET and FAPESP have jointly encouraged Research on Biodiversity by participating in the Newton Fund initiative for Biodiversity in Latin America. This resulted in multilateral projects together with CONCYTEC of Peru and CONICYT of Chile.

Beyond funding the collaboration between researchers and groups,

FAPESP promoted the discussion on Research Infrastructure in Latin American, aiming at the complementation of national capacities and the optimization of resources. In this regard we must point out the investment in research facilities of regional impact even outside Brazil. FAPESP, the University of Sao Paulo, the Ministry of Science Technology and Innovation of Argentina and CONICET are associated in the construction and operation of the LLAMA Long Latin-American Millimetric Array radio telescope located at 4500 meters high in western Argentina. LLAMA will expand the scope of the European ALMA observatory placing our communities at the forefront of radio astronomy research. We must also remark the funding from the Ministry of Science Technology Innovation and Communications of Brazil and FAPESP of the synchrotron light laboratories LNLS and currently Sirius at the CNPEM in Campinas. The community of Argentine researchers are the leading foreign users of this regional facility thanks to a contribution from CONICET.

We must highlight the role of FAPESP in building consensus with similar agencies around the world on common issues. Together with the German Research Foundation DFG and CONICET, FAPESP organized the annual meeting of the Global Research Council of 2019. The three institutions gathered the world research funding agencies to discuss and conclude on the topic "Addressing Expectations of Societal and Economic Impact of Scientific Research" in São Paulo in May of that year. The vision of FAPESP was crucial in the preparation of preliminary documents, the accompaniment of regional deliberations, the synthesis of the final document and the dissemination of its content during the plenary event in Brazil.

In each of these cases we must appreciate the dynamism of FAPESP and the leadership of Prof Carlos Henrique de Brito Cruz whom we celebrate today.

National Research Foundation of South Africa (NRF)

CELEBRATORY REMARKS: SHORT NARRATIVE ON THE NRF/FAPESP PARTNERSHIP

Molapo Qhobela
Chief Executive Officer

Developing nations should be proactive to invest in inspirational projects that capture the imagination of society and future generations of scientists. Such projects also assist in attracting and retaining exceptional talent. Developing nations, in part given the small size of its science systems, need to take advantage of unique characteristics such as geographical location, natural endowments and/ or competitive advantage in capacity and or capability.

As science granting councils, we must find ways to make strategic interventions, focused on key priorities, which will yield the best results. We must build partnerships within our national systems of innovation. We must work with and for the communities where universities are located. We must build international partnerships and learn from international best practice. And we must be determined in our actions in order to ensure that our common futures deliver even more.

South Africa and Brazil have enjoyed strong bilateral relations since our country's transition to democracy in 1994. The engagements are underpinned by a common desire to contribute to the global knowledge agenda in a manner that reflects the aspirations of our developing economies, as well as south-south cooperation. The Fundação de Amparo

à Pesquisa do Estado de São Paulo (FAPESP) has been an important and leading partner, and the National Research Foundation (NRF) of South Africa has been honoured by its association with FAPESP. Our 5-year interagency agreement strengthened and improved research capacity across public universities, science councils and research facilities in both Brazil and South Africa, with prominent research outputs and significant human capacity development.

For the future, it is our intent to deepen the partnership with FAPESP, acknowledging its leading scientific and international development role, with a focus on research infrastructure development and the expansion of support to early career researchers. Developments such as the recently launched South Africa Isotope Facility (SAIF) based at the NRF's iThemba LABS, and the newly completed Synchrotron Light Source (SIRIUS) in Brazil provides significant potential and opportunity to amplify our collaboration for long-term sustainability. Strategic prospects like these will create a prominent platform in the context of large-scale, geo-economic endeavours, like the Brazil-Russia-India-China-South Africa (BRICS) framework for further expansion of excellent research.

With the inspirational vision of Prof Cruz, FAPESP has led a significant increase in the quality of research developed in the State of São Paulo. These strategic and informed efforts are recognised globally, reinforcing inclusive cooperation policies cognisant of environmental and social risks of a growing international development agenda. Indeed, the critical role of funding agencies to address common issues faced by global science, build trust between research funding organisations and foster multilateral research cooperation, is a significant legacy that Prof Cruz established, inter alia through his chairship of the Global Research Council. He has been instrumental in leading this increasingly influential network to shape inter alia the discourse on the role of public funding agencies to improve communication and collaboration between research

councils; to address challenges of ethics and integrity, and peer review; gender equity; and to support the establishment of world-class funding organisations in countries with an emerging research investment.

The leadership of FAPESP and Prof Cruz in the launch of the South Africa – Brazil Science Plan for Research Cooperation on the South Atlantic is an important milestone to catalyse not only South-South cooperation, but global cooperation, including engagement between African and South American countries. It also extrapolates and complements the efforts of the Atlantic Ocean Research Alliance.

Science knows no borders. International cooperation is imperative for science to advance and to improve the quality of living of all on our planet. No country is strong or big enough to act on its own. We need to join forces – share our resources, experience and expertise. Shared global challenges like climate change, food security and poverty and inequality demand a united global response. In this context the importance of co-creation for common investment to address shared challenges by partners in our science, technology and investment capacities, cannot be underestimated. The National Research Foundation stands proud in its association with FAPESP as it continues to be a beacon of leadership, innovation and inspiration in science excellence.

Social Sciences and Humanities Research Council of Canada (SSHRC)

BUILDING A WORLD-LEADING RESEARCH FUNDING AGENCY

Ted Hewitt, President

For nearly two decades, Dr. Brito Cruz has proven invaluable in promoting collaboration in research across the disciplines between Brazil and Canada. This extends to early work we undertook soon after his arrival at FAPESP to establish a unique partnership between FAPESP and two leading Canadian universities – the University of Toronto and the University of Western Ontario – to fund leading-edge projects linking researchers at these two institutions and collaborators at institutions in the State of São Paulo. The model we developed was later copied by other Canadian institutions and continues to be a source of pride for the Canadian partners.

Since that time, Dr. Brito Cruz has led collaborative initiatives with many of Canada's leading research funding organizations. He was instrumental in developing the 2012 Memorandum of Understanding (MOU) between FAPESP and the Natural Sciences and Engineering Research Council of Canada (NSERC), which led to collaboration on two large training initiatives in 2014. This partnership – which remains active – also helped deepen policy and information exchanges between the two organizations. FAPESP and NSERC share seats on the Governing Board of the Global Research Council, of which he was elected Chair following its 8th Annual Meeting hosted by FAPESP.

Further, in December 2017, Dr. Brito Cruz hosted the Brazil-Canada Health Research Cooperation meeting in São Paulo. This meeting yielded very successful and productive exchanges between the Canadian Institutes of Health Research (CIHR) and FAPESP. CIHR's Scientific Directors were able to establish direct links with their counterparts at FAPESP as well as share information on key health research priorities in Indigenous health, health services, personalized medicine, healthy cities and infectious diseases. In addition, CIHR and FAPESP are members of the Global Alliance for Chronic Disease, through which they have engaged directly regarding strategic directions for the network.

Dr. Brito Cruz was instrumental also in signing a research agreement in December 2017 between FAPESP and Canada's International Development Research Centre (IDRC). To date, the agencies have organized two research funding calls. The first was focused on innovations for economic inclusion of marginalized youth. The second focused on the role of small business in Aedes mosquito control technologies, aiming to stimulate south-south collaboration for the development of innovative vector control technologies with a focus on the prevention of Zika and other Aedes transmitted diseases.

Last but not least, working with the Social Sciences and Humanities Research Council of Canada (SSHRC), Dr. Brito Cruz has led FAPESP's active involvement in the Trans-Atlantic Platform (T-AP), a consortium of over a dozen funding agencies focused on social science and humanities research in Europe and the Americas. Over the years, FAPESP has been a faithful participant in T-AP's funding calls. Dr. Brito Cruz was recently named a T-AP co-chair, and has advocated strongly for increased involvement of Latin America funding agencies in the consortium as well as the inclusion of new ones from Africa. Towards this end, he has led FAPESP's involvement in planning a workshop for August 2020 to create a T-AP Latin American Hub. The title of this event will be: The Transatlantic Platform (T-AP) for research in Social Sciences and the

Humanities: Open Science, Big Data, Artificial Intelligence.

I have no doubt that others will write glowingly of Dr. Brito Cruz's unquestionable contributions as a scholar, and of his role in building the capacity and reputation of FAPESP as a world-leading research funding agency. I strongly endorse these assessments. For me, however, it is his successes in building successful relations with Canadian institutions and funding agencies that truly stand out as exceptional. I am very proud to count him as a colleague, and as a 'co-conspirator' in building these critical links. I am only sorry that he did not manage to visit Canada more often!

On behalf of all my colleagues in Canada, I wish Dr. Brito Cruz all the best with his next undertaking, which I am sure will continue to contribute exceptionally to the strengthening of the Brazilian and the global research environment.

Brazilian National Council of State Funding Agencies (CONFAP)

ABOUT PROFESSOR CARLOS HENRIQUE DE BRITO CRUZ

Evaldo F. Vilela, Chair

The successful path trod by FAPESP – *Fundação de Amparo à Pesquisa do Estado de São Paulo* – emboldens all Brazilians like us, dedicated to the development of Science and to its applications in benefit of society. FAPESP's success story is naturally the consequence of the vision, intelligence and determination of those who created it, who led it and lead it today. Such is the case of Brito Cruz, who, with his leadership, expanded FAPESP well beyond São Paulo's borders in the past few decades. For us members of CONFAP – *Conselho Nacional das Fundações Estaduais de Amparo à Pesquisa*, which brings together all 26 Research Support Foundations in Brazil, FAPESP and Brito Cruz have become references when it comes to valuing Science as an asset to society, aiming at the development of the state and the country. Thus, we always remind ourselves that FAPESP grew not because the state of São Paulo is rich. But on the contrary, FAPESP has contributed decisively to the wealth of the state of São Paulo, by means of the innovative capacity of its scientific community and its talents, in combination with the productive economic forces of São Paulo society, who, differently from other states and from the country itself, chose in the past to make knowledge the base for the construction of a modern state, capable of promoting the welfare of its population. Brito Cruz is one of the stars in this constellation of

visionary intellectuals and tireless operators for São Paulo and for Brazil.

A renowned scientist, recognized nationally and internationally, and a leader admired for his firm commitment to quality in everything he does, Brito Cruz and his work have raised the level of fostering and promotion of scientific and technological development in São Paulo. His role in promoting institutional cooperation was extraordinary, with the number of active agreements growing to hundreds since he took over FAPESP. International cooperation with universities, other Research Agencies and companies, and, more recently, agreements with sister Research Support Agencies created valuable opportunities for mobility, network research and experience exchanges – and nothing could be more important in a world undergoing great transformations. Internationally, FAPESP gained great relevance, increasing its role significantly by means of extensive diplomatic action, complemented by events in Brazil and abroad. Such efforts were recognized when Brito Cruz became a member of various councils abroad, such as the American Physical Society, The Barcelona Supercomputer and the committee that promotes every year the Queen Elizabeth II Prize for Engineering in the United Kingdom.

With admirable knowledge of the most diverse fields of scientific knowledge, Brito Cruz often defies established concepts, basing himself in expertly collected data, well-prepared summaries and an impressive capacity to identify patterns. For many years, he has disagreed with the allegation that the Brazilian industry lacks advance because Brazilian universities do not contribute to innovation. Recently, he found figures demonstrating that many of our universities, especially the Federal University of Viçosa, have a volume of cooperation with companies that is comparable to some of the best in the world. Anyone who works with him regularly is also impressed by his uncommon memory, capable of retrieving important scientific results in instants.

Before becoming Chairman of FAPESP in 1996, Brito Cruz had a successful career at University of Campinas (UNICAMP), at the Gleb

Wataghin Physics Institute, where he concluded a Master's Degree and a Doctorate and became a Full Professor at the Quantum Electronics Department. His experience as a public manager began with the positions of Director of the Physics Institute and Pro-Rector of Research, both at UNICAMP. He would later serve as President of UNICAMP between 2002 and 2005.

However, his contributions go beyond UNICAMP and FAPESP. Brito Cruz is also a member of the Brazilian Academy of Sciences and a Fellow of the American Association for the Advancement of Science. He received the *Ordre des Palmes Academiques* in France, the Order of the Scientific Merit in Brazil and the Order of the British Empire, Honorary (OBE). Recently, Brito Cruz was elected Chair of the Governing Board for the Global Research Council (GRC) for a one-year term, where, among other positions, he now plays an active voice in supporting and developing Science, Technology and Innovation globally and in Brazil.

All this thanks to a solid educational background as an Electronics Engineer and Physician, graduated from the Aeronautical Technology Institute (ITA), and to passages in renowned laboratories such as the Quantum Optics Laboratory at Universitá di Roma, the Femtosecond Research Laboratory at Universitè Pierre et Marie Curie, and the AT&T's Bell Laboratories. A great part of his scientific career was dedicated to the field of optics, focusing on ultra-rapid phenomena, lasers (particularly ultrashort pulse lasers) and semiconductors. At UNICAMP, Brito Cruz created a research group that has since been making significant contributions to these fields of knowledge, as well as creating opportunities for competent young researchers. With this fruitful career in scientific research, higher education and public support for Science, Brito Cruz's work is a prominent and notable example of diligence and passionate dedication to Science, Technology and Innovation.

Along 15 years managing FAPESP, Brito Cruz launched unprecedented programs, a result of his vision of what Science and

Industry may achieve together. One of the most successful examples is the Engineering Research Centre, with long-term projects co-financed by companies. Brito Cruz made history in FAPESP and gave us the certainty that we do not need to seek examples abroad to model the promotion of a prosperous economy based in knowledge, making it possible to bring the future to every Brazilian state.

UNICAMP

University of Campinas

BRITO CRUZ:
A LEGACY OF ACADEMIC EXCELLENCE

Marcelo Knobel, Rector

My relationship with Prof. Carlos Henrique de Brito Cruz started in 2001, when he invited me to participate in his team during his second term as the director of the Gleb Wataghin Physics Institute (IFGW), of the University of Campinas (UNICAMP). He invited me to collaborate with Prof. Leandro Tessler in the undergraduate coordination of the Physics Institute. Prof. Tessler was the Undergraduate coordinator and I was the associate coordinator. Quickly I learned how fast Brito was to catch up new ideas, and he always asked for some written proposal. As soon as he looked at the text, a glimpse was enough for him to identify an inconsistency or an error. So, the first lesson was to be extremely careful with the ideas, and how to communicate them. A second lesson, quickly learnt lesson, was to choose wisely when to discuss with him. Sometimes other issues were populating his spinning mind, and the responses could be rather evasive or harsh. Finally, I am always impressed on how careful he is regarding the documentation of any idea or process that he wanted to create. He was very clear to teach us that we should document and archive any single action in a file, not only for organization purposes, but also for keeping things clear from the historical perspective. Keeping in mind those important lessons, we have started a very fruitful relationship, not only from the professional viewpoint, but also as good friends.

I had the chance to help in his campaign for Rector, and just after he started his term in 2002, a group of faculty members presented to him the idea of developing a Science Museum at UNICAMP. During his term he helped in any possible way to make this idea to prosper, constituting a working group to further develop the project, and helping to contact possible sponsors, foundations, and any opportunity that the group would foresee to make it happen. He was really an enthusiast of the idea, who finally prospered to the creation of the Exploratory Science Museum of UNICAMP. It is important to have the opportunity to make this fundamental recognition in this text, because many times the support in the background, hours of meetings, travels, and conversations are lost in the process and with the inexorable flux of time. In any case, the Science Museum was just only one of the many achievements of his term as a Rector, and important legacy was left from his leadership.

In 2005 he needed to make a very difficult decision. He was considered to become the Scientific Director of FAPESP, and he needed to decide if he would resign of his rectorship at UNICAMP before the end of his term. As there is a consultation, with campaign, to become rector, there is an important obligation with a program who is discussed with the internal community. For a person with the character and public commitment such as Brito, I can imagine that this was a very complicated choice to make. I personally believe, and I am confident that this is shared by most of the UNICAMP's faculty and staff, that the presence of Brito as the Scientific Director of FAPESP was fundamental not only for the University itself, but also for the State of São Paulo and for the country. From the point of view of the University, it is part of its role to contribute to the development of science and technology for São Paulo and for Brazil. As public servants, the employees of the University must be ready to contribute in any possible way, to further stimulate the culture of science and development. In this particular case, the leadership aptitudes of Brito for this job are unquestionable, and

thus, this personal decision, sheltered by the University, now proved to be the correct one. Evidently, there is an important visibility factor for the university as well, because the reach of the international influence of Brito also carries together the name of UNICAMP, contributing to its prestige. I strongly believe that also FAPESP and consequently the State of São Paulo and Brazil were benefited by this fortunate decision. In this collection of articles one can see the extent of Brito's contributions for the strengthening of FAPESP mandate to develop science, technology and innovation in this state. Many new programs were launched, and all universities and research institutions of the state are now benefiting from these innovative ideas and programs. There was an unprecedented growth in international collaborations, as well as the emergence of a new program connecting companies and universities, which will certainly bring interesting results in a near future. Many other improvements in the internal processing and decision making structure of the Foundation were implemented, which were certainly less visible for the external public, but very important for the daily work and efficiency of FAPESP.

I had also the chance of working with Brito at FAPESP during his term as Scientific Director. Initially he invited me to be a member of the Physics and Astronomy Coordination, a position I held for three years. It was important to better understand the internal functioning of FAPESP, and also the status of research in Physics in the State of São Paulo. The atmosphere of the work at the coordination, with the colleagues from Physics and other fields, was really amazing, and good friendships resulted from this period. In the meantime Brito asked me to help organizing some international meetings, such as the "Frontiers of Science" with the Royal Society, reassuring day after day my impression about the global perspective of science collaboration that he brought to FAPESP. In 2012 he invited me to organize the FAPESP Week symposiums, a new challenge in my career. I was the coordinator of 11 FAPESP Weeks, from 2012 to 2016 (Salamanca/Madrid, Tokyo, London,

North Carolina, Beijing, Munich, California, Buenos Aires, UC Davis in Brazil, Barcelona, Michigan/Ohio and Montevideo). It was really a wonderful experience, and I think it was an important contribution for the internationalization of science in the state of São Paulo.

After becoming Rector of UNICAMP, evidently my relationship with Brito kept evolving, always with good discussions regarding the development of science and technology in Brazil, the role of public universities, and ideas for new projects not only for UNICAMP, but also for the whole system of Science, Technology and Innovation of the country. I had the chance to write together with him a couple of papers and opinion texts for Brazilian newspapers, and it is always a pleasure to work with a diligent and smart person, who really thinks out of the box. But more importantly, always based on evidences! Brito is really good at data mining and he is well-known for making convincing graphs and wonderful presentations.

In conclusion, I am personally very grateful for this evolving friendship with Brito, which made me know him better each day, endorsing his leadership and vision of higher education, science, technology and innovation for the sustainable development of the country. From the institutional viewpoint, Brito has implemented many novel programs, methods and projects at FAPESP, which directly benefited all the science, technology and innovation sector of the State of São Paulo. UNICAMP is very proud of having him as a full professor, acknowledging his service during all these years as a Scientific Director of one of the most important support agencies of Latin America. Thank you Brito!

UNICAMP

BRITO CRUZ, THE TRAJECTORY OF A LEADER SCIENTIST AND SCIENCE POLICY MANAGER

Ricardo de Oliveira Anido (IC), Roberto de Alencar Lotufo (FEEC)

Brito Cruz is the first of three sons of a former priest and a schoolmaster. Dona Helena, his mother, owned and managed a primary school, which he and his brothers attended. He recalls he decided to study Physics while in High School, but his Physics teacher at Dante Alighieri School in São Paulo convinced him to first study Electronic Engineering, for this would give him a stronger background in Mathematics, and so Brito went to the Aeronautics Institute of Technology (ITA).

We both first met Brito on our first day at ITA and have had the privilege of sharing his friendship and following his career for more than forty years. From his student years at ITA Brito has shown the qualities that have made him respected worldwide as a scientist and as a science administrator: scientific rigor, intelligence, brilliant insights, entrepreneurship, commitment to results, power of persuasion by using facts and data.

As a freshman at ITA Brito Cruz started lecturing Physics at the prep school maintained by the ITA Student Union. Showing exceptional commitment and organizing abilities, he soon became the Director of the prep school. We remember him doing almost everything besides giving lectures: writing, editing and printing students' booklets containing texts and exercises, preparing and applying simulated tests on weekends,

bookkeeping and managing the small staff... At the same time, he started studying more intensely his chosen topic, Physics, more specifically lasers. Showing remarkable entrepreneurship, as a sophomore Brito Cruz started a company, together with two more senior ITA students, to produce commercial lasers. The first machine they developed and sold used a laser to make holes in pipes for irrigation in agriculture. Brito left the company after a couple of years but bought his first car (a green VW Brasilia) with the money earned from that first machine the company sold.

At ITA Brito was a brilliant, outstanding student, but on a more personal side had a social life like all other students: girlfriends, weekly movie sessions, beach on school breaks... He did, however, show an uncanny amount of focus and determination even when amusing himself, from riding a skate – the first we ever saw – downhill to see how fast it would go (and measuring it), to learning to ride a bicycle backwards like in the circus (which he did, after reasoning the physics of it and uncountable falls). And it amazed us that he was able to study while listening to loud music, with a somewhat eclectic repertoire that included Frank Zappa, Bob Dylan, Jefferson Airplane, Crosby, Stills, Nash & Young, Leonard Cohen, Victor Assis Brasil and Lô Borges. Brito can be seen among hundreds of spectators in the double page photography in the vinyl album Minas, taken during a Milton Nascimento show in São Paulo.

At the end of the engineering course at ITA a group of our class of 1978 moved together to Campinas, to pursue an MSc at UNICAMP (University of Campinas), in different areas: Mathematics, Electrical Engineering, Computer Science. Brito of course chose Physics.

At UNICAMP he was at his chosen field of study, and his scientific work flourished. He finished his MSc and spent an academic year at Università degli Studi Roma Tre, in Rome, Italy, while pursuing his PhD at UNICAMP, which he completed in 1983.

As a young Assistant Professor, he set up his own laboratory at

Gleb Wataghin Institute of Physics (IFGW), supervising MSc and PhD students. Continuing his multifaceted work, he was elected second vice-president of the Teachers Association of Unicamp (ADUNICAMP). Brito then spent a year as a postdoctoral fellow at Bell Labs (AT&T Bell Laboratories) in New Jersey.

All these early activities, mixing high quality science, business experience, administration and academic politics, paved the way to the rest of his career. Brito went on to be the Director of Gleb Wataghin Institute of Physics (IFWG) and Research Chancellor at Unicamp, again Director of the IFGW and finally UNICAMP's President. In parallel to his career at Unicamp, Brito started working at FAPESP quite early, being elected a member of the Superior Council, then President and finally Scientific Director. In each and every one of these roles Brito had a fundamental impact.

During his tenure as UNICAMP's Research Chancellor, he improved the process of collecting the University indicators, from research and teaching, so that the university could distribute part of the budget based on those indicators. These metrics are still used today.

When he was President, he devised and created the Innovation Agency of the University, Inova Unicamp, one of the first in Brazil and which served as a model for many other universities. Brito provided the basis for Unicamp' s national leadership in the area of intellectual property, collaborative research projects with industry and entrepreneurship.

As a President he also led the initiative to create the PAAIS (affirmative action and social inclusion program), an innovative program which opened up the University to candidates from public schools and minorities. He was an "inclusive" President.

While working on all those achievements, Brito Cruz has valued his personal and social life, being an affectionate husband and a caring father, playing the electric guitar, promoting a ballroom dance course in his house every Saturday for eight years, and cooking one the most

delicious bacalhau (salted cod) dishes for his friends, since Brito always wants to achieve perfection.

His experience, knowledge, intelligence and previous achievements made him an excellent choice for Scientific Director at FAPESP. We were sure that he would be an outstanding scientific leader and manager for the promotion of Science in the state of São Paulo. And, of course, he proved all of us right.

SÃO PAULO RESEARCH FOUNDATION (FAPESP)

Adjunct Panel (CAD)

Life Sciences

Physical Sciences and Engineering

Research for Innovation

Social Sciences and Humanities

Special Programs and Collaboration in Research

Multi-user Equipment

Adjunct Panel (CAD)
Life Sciences

CARLOS HENRIQUE DE BRITO CRUZ: A TESTIMONIAL

Anamaria Aranha Camargo, Carlos Eduardo Negrão, Francisco Laurindo, José Roberto Postali Parra, Maria Julia Manso Alves, Marie Anne Van Sluys, Walter Colli

Life Sciences are supervised by two panels, called CAD Health and Biology and CAD Agronomy and Veterinary. The CADs help make decisions on grant aids and fellowships, among others. When Brito was nominated in 2005, CAD Health and Biology had two members and Agronomy and Veterinary was void, being supervised by one of the remaining Health and Biology CAD members. At that time, FAPESP received yearly approximately 5,000 applications. Now, this number raised to 26,000, meaning that the number of annual submissions for the life section nears 13,000-15,000 applications, approximately. As a consequence, CAD Life Sciences expanded and currently has 7 members. This is a clear demonstration of the impact of Brito's activities at FAPESP that expanded the opportunities in research in all fields.

Brito put forward numerous initiatives during his period as the FAPESP Scientific Director such as the creation of the São Paulo Schools of Advanced Science, the São Paulo Excellence Chairs, the Research Internships Abroad (BEPE), the Young Investigator Award 2 (JP2) program, that allowed successful young researchers from JP1 round to have another grant for additional 60 months. Also, new multidisciplinary programs took shape such as BIOEN, e-Science,

among others. Not to mention the reinforcement and expansion of existing programs as Research, Innovation and Dissemination Centers (RIDCs), FAPESP Research Program on Biodiversity (BIOTA), Multiuser Research Infrastructure. Other areas where he put much effort were the Science-Industry partnership program Research Partnership for Technological Innovation (PITE) and the Innovative Research in Small Business Program (PIPE) which stimulates and supports new startups. In the area of innovation, it is necessary to emphasize the creation of the Engineering and Innovation Centers (ERCs) bringing together universities and private companies to exploit a common theme in a 10 year's timeframe, a very successful initiative. Another program that grew remarkably is the Research in Public Policies Program (PPSUS), aiming at strengthening the Unified Health System (SUS) in the State of São Paulo in partnership with the São Paulo State Department of Health, the Ministry of Health (MS) and the National Council for Scientific and Technological Development (CNPq).

One of Brito's notable initiatives was to strengthen the collaboration among researchers from Brazil and around the world with science made in São Paulo, establishing agreements with foreign Universities and Research Funding Agencies. Impatient by nature, the slow learning curve of the scientific community was somewhat a frustration.

An important decision was to include in all projects the so-called Technical Reserve, which not only gives the proponent a fraction of the budget for administrative costs but also provides an aliquot to be managed by the unit where the investigator works for collective benefit. In this line, he put a remarkable effort to persuade the leaders of universities and research institutes to provide administrative support to their scientists in order to relieve them from the burden of project management. Another initiative during his period as a FAPESP Science Director, was to educate the community to share big equipment. This was particularly important in the areas of Health, Biology, Agronomy, Veterinary and related areas.

Brito always pursued the quality and the relevance of the scientific questions being proposed, an ideal that he always passed on to his collaborators. Eager to plan ahead the FAPESP's research activities he also reacted immediately to unforeseen scientific challenges. As an example, when we were struck by the Zika epidemic in late 2015 and early 2016, he defined a fast track to support virologists to study the subject. This allowed a fast response of the scientific community, which generated many publications. That strategy made São Paulo one of the main producers of knowledge on the subject at that time: the first experimental demonstration of neural lesions by the virus, the stimulus to develop diagnostic kits which minimize cross reaction between Zika and Dengue sera, and several studies using cohorts of patients, among others. As a consequence, one of the CAD members was elected Vice-Chair of Global Research Collaboration for Infectious Disease Preparedness (GloPID-R), an international network of major research funding organizations.

One of Brito's concerns was to bring science to the public and he made that through many initiatives through interviews, attending round tables, by supporting the magazine *Pesquisa FAPESP* and through the scientists themselves by ruling that each RIDCs should have its own journalist.

CAD Health and Biology used to meet on Mondays and Thursdays. Obsessed with numbers, Brito visited us often bringing tables and charts related to FAPESP expenditures or statistics of papers published by scientists from São Paulo. Even being a Physicist by training, he frequently came with the most recent life science article published in that very same day, asking questions, though we suspect that his intention was not scientific, but rather to visit our jar full of cashew nuts. He also was glad to invite us for lunch but didn't wait too long for people to get together. Always in a hurry, he was the first to finish eating and invariably asking whether everyone was ready to go back to work. On Mondays, the fans of the soccer team of São Paulo noticed that he only

asked about soccer results when Corinthians had won.

In short, Brito never used adjectives to define the word Science, whether it would be basic, applied or technological. His concern was with quality and relevance. He was always willing to listen and gather people around his ideas. Science in Brazil owes much to him.

Adjunct Panel (CAD)
Physical Sciences and Engineering

THE ART OF CREATING A HEALTHY TENSION AMONG DIVERSE POINTS OF VIEW

Francisco Antônio Bezerra Coutinho, José Roberto de França Arruda, Roberto Marcondes Cesar Junior, Wagner Caradori do Amaral

In recent years, scientific results have been questioned by some segments of our society. It is interesting to try to understand how science and technology, which are helping to solve some contemporary societal problems, have appeared and developed. In March 1989, a young researcher at the European Center for Nuclear Research (CERN) in Geneva presented a proposal for a data management and sharing system. Tim Berners-Lee was proposing to create the World Wide Web. His boss noted on the cover of the proposal: "vague but exciting". Today, the WWW connects the world. The datasets and software code shared thanks to the WWW form the basis for the AI algorithms that are controlling human drivers and cars, medical equipment in hospitals, and credit card fraud detection systems. The vague but exciting idea changed the world and, 30 years later, helps solving an increasing number of problems of public interest. This story illustrates how research and excellence evolve in an intricate way from basic, vague ideas in all fields of knowledge to become useful tools for the benefit of society. Brito has always understood this very well.

The main research funding agencies around the world have played a central role in the development of such basic and applied research since the mid-20th century. Research funding agencies connect the key

science, technology, and innovation stakeholders: researchers, research institutions, students, government, companies, and society. By connecting such diverse points of view, the funding agencies create a tension among them. If well managed, the funding agencies are able to create a healthy tension, which frequently leads to fruitful results. This is probably one of the main achievements of FAPESP under Brito's leadership.

It is interesting to note that Brito has been paying attention to such topics for a long time. As Director of the Physics Institute at the University of Campinas (UNICAMP), its Vice-President for Research, and its President (Rector), his main aims were to improve excellence in research and education for students, as well as guaranteeing that research results had an impact on academia, industry, and society. To achieve this goal, he implemented many actions, of which we would like to describe one in particular: the creation of UNICAMP's Innovation and Entrepreneurship Agency, called INOVA. Besides promoting and transferring technology, INOVA provides resources for startups. This is just one example of the many achievements for which Brito has been responsible for in the last 30 years at UNICAMP, and which have had a significant impact, not only on the industry, but on society as well. His continuous emphasis on the development of challenging and impactful research, deeply connected to the international research landscape, helped to shape the modern research activities in the State of São Paulo. In order to have a better idea of such important initiatives, it is worth mentioning some of the concrete measures implemented by Brito at FAPESP.

FAPESP has intensified the emphasis on Thematic projects and other more ambitious funding mechanisms. The Foundation has raised the standards of the Young Researcher award, which funds promising young researchers working on cutting-edge topics to establish their research groups and created the Young Investigator Phase 2 program to bridge the gap between YI Phase 1 and Thematic projects. These are all funding mechanisms that demand that researchers get together in

larger, frequently multidisciplinary groups, and propose bolder research challenges with high potential impact in terms of scientific knowledge and societal development.

This effort pervades all FAPESP's activities and can also be observed, for instance, in the review forms used by FAPESP to evaluate proposals. Here also, one can observe this shift from traditional, "accountant-like" appraisals, such as number of papers, number of patents, theses and dissertations etc. to a deeper evaluation of the quality of the project, such as the relevance of the scientific challenge and the novelty of the methodology. But this demands a significant effort in terms of conversations with the specialist panels, interviews with researchers and discussion with the community, given whenever FAPESP was invited to a scientific event. It became more frequent to ask reviewers to redo their review in order to provide FAPESP with more relevant information about the science being proposed.

Focusing on emerging fields of research, he proposed new programs on strategic issues. For instance, FAPESP's Bioenergy Research Program (BIOEN), FAPESP's Research Program on Global Climate Change (RPGCC), and the program on e-Science and Data Science. His work on the systematization of the Multi-user Shared Facilities (EMUs) has been producing important results in the rationalization of investments and has facilitated the access to research infrastructures by the research community of the State. Brito has strongly encouraged international cooperation with foreign agencies, universities, and companies. The results achieved by FAPESP undoubtedly contributed to the growing visibility of the science and technology produced in São Paulo, which currently cooperates with 60 different countries under more than 200 agreements. He also started the São Paulo Schools of Advanced Science (SPSAS), which offer funding for the organization of short duration courses in advanced research in different areas of knowledge in the State of Sao Paulo. Thousands of researchers and students from several

countries attended these schools, establishing, in the State of Sao Paulo, a globally competitive hub for talented researchers. Another Brito initiative was a program to support short- and medium-term research internships abroad, open to all recipients of FAPESP fellowships.

Consider, additionally, two success cases in scientific instrumentation development that have been supported by FAPESP in the last decade. International research centers, such as CERN in Geneva or Fermilab in Illinois, are permanent sources of S&T&I revolutions that have been changing the world for decades because they concentrate researchers and students who create knowledge incessantly. Researchers from the State of São Paulo's universities, in cooperation with these and other centers, are creating technologies with very Brazilian names, such as the SAMPA chip for the LHC or the ARAPUCA light detector for DUNE. This is cutting-edge technology that works in the most extreme conditions, studied and developed by São Paulo's institutions. CERN conducts experiments reaching some of the highest and lowest temperatures in the universe. We are talking about 5.5 trillion degrees Celsius! At the same time, the ARAPUCA device (so called because it "traps" photons) works in a pool of liquid argon with a temperature below –180 degrees Celsius! By 2018, such experiments achieved a data throughput of 7.4 GB / s. This rate would allow streaming all episodes of an entire Game of Thrones season in 2 seconds... No fewer than 88,000 SAMPA chips are currently being integrated into the LHC. Hundreds of ARAPUCA systems will be produced and tested in some of the most advanced international neutrino study experiments at DUNE. ARAPUCA's inventors won the 2018 DPF Early Career Award from the American Physical Society. Additional examples of the key role played by researchers from São Paulo in international collaborations can be found in astronomy, physics, chemistry, mathematics, computer science, geosciences, and engineering, to name but a few.

Moving from the international landscape to the national one, it is

interesting to note how researchers from the State of São Paulo have been continuously working with other sectors of society, such as government and private enterprises to develop new life-enhancing tools. FAPESP has been funding several initiatives, such as the Research, Innovation and Dissemination Centers (RIDCs) and Engineering Research Centers (ERCs), in an exemplary partnership with companies. Research at these centers addresses issues such as more resilient and functional materials, disease understanding, improved productivity and lower costs in the industry. But they also deal with urban violence and the impacts of inequality on the public education system. Besides funding research, FAPESP coordinates researchers, research institutions, partner companies and international evaluation committees into an interconnected engine that continuously improve the excellence and relevance of the research carried out by the centers. In fact, the ERCs have become the largest program of research collaboration between academia and industry in Brazil, producing high-level, internationally competitive research results and training high-quality human resources. There are currently 17 RIDCs and 14 ERCs, and the numbers are increasing steadily thanks to the success of the program. FAPESP recently announced the creation of eight ERCs on artificial intelligence and applications, four of them in the State of São Paulo . The ERC program alone involves total funding of PPP$ 540 million by FAPESP, the partner company, and the host research institution. These results, alongside the data collected by Brito on joint University-Industry publications, help to better clarify and demystify the common assumption that the collaboration between academia and companies in Brazil is weak.

Brito's time at FAPESP will leave a long lasting, extremely positive influence, and will certainly continue to bring significant scientific results in the future, as researchers look for high-level, challenging (possibly vague), and exciting research ideas. His work as the Scientific Director consolidated FAPESP's place at the same level as the best funding agencies in the world.

Adjunct Panel (CAD)
Research for Innovation

HOW TO TRANSLATE GOOD IDEAS INTO TANGIBLE RESULTS

Américo Martins Craveiro, Douglas Eduardo Zampieri, Fábio Kon
Lucio Angnes, Sérgio Robles Reis de Queiroz

Prof. Brito Cruz's contribution to the FAPESP initiatives in the area of Research for Innovation is remarkable. The results achieved during his term as Scientific Director, which we will mention below, attest to that fact. Before that, it would be the case to note that he always understood that innovation, in addition to being fundamental for the economic and social development of a nation, maintains a close relationship with the research activity, whose promotion in the State of São Paulo is FAPESP's central mission.

Going back in time, it may be possible to speculate that Brito was building this understanding of the research-innovation relationship throughout his education and academic career. Still in the second year of his undergraduate studies in Engineering, he was one of the creators of Lasertech, a company focused on industrial laser applications, which emerged from casual experiments that the undergrad student performed at Aeronautics Institute of Technology (ITA) laboratories. Later, as a professor at University of Campinas (UNICAMP), he had the opportunity to spend time as a researcher at Bell Labs, working in a laboratory associated with the world's most important communication equipment company at the time.

The experience abroad consolidated the perception that innovation,

especially the one with high impact, emerges from the association with basic and applied research. This made it clear that the university, a place where research takes place, has a lot to contribute to the company, a place where innovation happens. In several articles, he helped to spread this idea, which is now much more widely accepted, that the company cannot wait for the university to innovate in its place. In the same way, the university does not compromise its objectives when approaching the company. More than that, the university gains from this relationship, mainly due to the better training of its students. Thus, as president of UNICAMP, Brito created INOVA, the university's innovation agency, to explore innovation opportunities based on the university teaching, research, and extension activities. This initiative was largely responsible for a series of similar actions by other universities across Brazil that created their own innovation agencies.

As FAPESP scientific director, since 2005, Brito gave a great impulse to the area of Research for Innovation, notably through the Innovative Research in Small Business Program (PIPE), Research Partnership for Technological Innovation (PITE), and Engineering Research Centers (ERC) programs. The first two, created by his predecessor, Prof. José Fernando Perez, had the support of Brito from the beginning. It is worth remembering his role as president of the Superior Council in the creation of PIPE in 1997 when, together with Perez, he faced a certain skepticism both in the academic community and in government sectors regarding the viability of the initiative. PIPE is today an undisputed success and had a remarkable growth during Brito's term as scientific director. The main objectives of the program are:

1. To support research in science and technology as an instrument to promote technological innovation, promote business development and increase the competitiveness of small companies;
2. Increase the contribution of research to economic and social development;

3. Induce an increase in private investment in technological research;
4. Enable companies to associate themselves with researchers from academia in research projects aimed at technological innovation;
5. Contribute to the formation and development of technological development centers in companies and to the employment of researchers in the market.

In its nearly 23 years of existence, PIPE has supported over 2,400 projects in 1,400 small companies in at least 125 municipalities in all regions of the State of São Paulo. A large number of startups were born from PIPE projects, and many established companies have expanded their investments and teams. They have successfully brought innovative products and processes to the domestic and foreign markets.

In the last decade, the program has grown significantly, from 50 to more than 250 projects financed each year. For this to happen, it was necessary to create the structure that today operates in several directions, with emphasis on the:

1. Wide dissemination of the program in teaching and research institutions, in industrial syndicates, innovation hubs, and small, medium and large companies;
2. Rigorous and ethical selection of high-quality proposals to receive public funding;
3. Disclosure, to the proposing company, of detailed expert reports issued by reviewers, which, in many cases, were fundamental for the elaboration and enhancement of high-quality projects;
4. Training of PIPE project coordinators in modern technological entrepreneurship techniques;
5. Improvements to the monitoring process of project progress;
6. Evaluation of the long-term impact of the program.

In all of these aspects, Brito's contribution to improving the instruments used by the program has always been essential. In particular,

in the matter of impact assessment, it is worth noting that this concern made him constitute an area specially dedicated to the evaluation of FAPESP's programs. This is another piece of evidence attesting to his capacity as a public manager in the area of scientific and technological policy, the perception that the institutional evaluation of programs is essential to make the necessary course corrections and render account to society in a transparent manner.

PIPE was framed after successful international experiences, such as National Science Foundation's (NSF) s Small Business Innovation Research (SBIR) program in the USA in the 1990s. The updates to the program over the years is also in line with good international practices, as illustrated by the creation of the High-Tech Entrepreneurship Training Program, nicknamed PIPE Empreendedor. It started in 2016, inspired by NSF's successful experience with its I-Corps program, created at the beginning of the decade. To create PIPE Empreendedor, instructors with vast experience in entrepreneurship in the North American program were brought to Brazil to train Brazilian PIPE startups and also experienced Brazilian specialists who became instructors in the São Paulo program. The program was then adapted to suit the Brazilian reality better and, currently, it has trained more than 500 professionals from 250 companies in 13 cohorts.

The recognized importance of the collaboration between the academic community and companies made Brito work hard to improve and strengthen the PITE program and to create, in 2010, the Engineering Research Centers (ERCs), a new, large-scale development tool for collaborative research.

Assuming that the advancement of knowledge, in many cases, comes from approaching and studying complex problems, which demands a cycle of studies and innovation greater than the 5 years, which was the limit of the PITE program, Brito created the ERC program. Based on its academic counterpart, the Research, Innovation and Dissemination

Centers (RIDCs) Program, ERCs stand out for being multidisciplinary, with the mission of developing research at the frontier of knowledge but guided by the search for well-defined results. Working in close collaboration, one or more large companies and a group of highly-skilled academic researchers seek to advance both science and its application to solve real-world industrial problems, making multiple sectors of society a beneficiary of the obtained results. One of the several benefits that the host academic institution enjoys, in addition to the research itself, is the opportunity to have access to a more eclectic and broad student education, which includes market vision and innovation. At least one researcher from the company participates in the daily activities of the center as a visiting researcher, acting as the Vice-Director of the ERC.

The first concrete results of the ERC program date from the beginning of 2013 and are recorded in that year's FAPESP Activity Report. There were four Calls, sharing an investment of R$ 114 million in 10 years in the areas of energy (Shell), sustainable chemistry (GSK), biofuel-based engines (PSA Groupe), neurosciences and behavioral sciences (Natura).

The success of this model made the number of ERCs grow to 10 in only five years. Including the new ones being negotiated and implemented, we are approaching 14 centers involving the above mentioned companies as well as Koppert, Equinor, Embrapa, Usina São Martinho, and IBM.

The last ERC implemented, in partnership with IBM, is the first institution in Latin America to integrate the IBM AI Horizons Network. This network was created in 2016 with the mission of integrating the company with the main universities and research institutes around the world to accelerate the application of Artificial Intelligence in different areas of human knowledge.

In addition to his good ideas and the ability to translate them into tangible results for the research and innovation ecosystem in São Paulo,

when managing the scientific board, Brito knew how to establish an enjoyable and lively environment. The meetings with the scientific advisors always had an interesting mix of serious work and good humor. We will miss having lunch together at the bakery next to FAPESP, when the discussion could go from the impact on science of the experiments that demonstrated the gravitational waves predicted by Einstein to the lastest episode of "The Crown". We will miss receiving emails about the latest developments in international science policy and advancements daily, including weekends. We will miss sending an email to Brito at 2:00 am requesting some feedback about a new enhancement to the PIPE program and receiving a response at 2:05 am. However, the greatest miss will be felt by the science, technology, and innovation system in the State of São Paulo and Brazil. But, given his nature, we are sure he will find several other ways of contributing to the development of the country.

Adjunct Panel (CAD)
Social Sciences and Humanities

HUMANISM AND KNOWLEDGE: A TESTIMONY

Ana Maria Fonseca de Almeida,
Luiz Henrique Lopes dos Santos, Paula Montero

It is the responsibility of research funding agencies designed to support advancement of science with public resources to apportion them in the way that best serves public interests. This maxim, however, is as trivial and simple to formulate as it is difficult to apply in real life due to the indefinite variety of aspects and values to be considered when it comes to identifying what best serves public interest in particular circumstances.

Research that directly results in technological innovations or public policies beneficial to society is doubtless of public interest. In so far as applied research is always somehow built upon results previously achieved through research conducted with no definite purpose of practical application, so-called basic research is also doubtless (or should be also doubtless considered) of public interest.

But this is not the only reason why basic research is to be thus considered, at least from a point of view that may be labelled *humanist*. From this point of view, an essential and distinctive mark of human action is the ability of human agents to rationally elaborate, on the basis of a stock of available knowledge, the various kinds of values and motivations involved in defining the ends of their everyday actions, and above all in choosing how to live their lives.

From the humanist point of view, the mere acquisition of knowledge, regardless of whatever tangible products and services it may provide, just by increasing this human ability is therefore of public interest. This point of view is precisely the one that underlies the broad conception of scientific knowledge traditionally adopted by FAPESP, which covers not only mathematics, natural and social sciences – sciences in the strictest sense – but all kinds of rationally structured and socially shareable knowledge, including the so-called humanities (as arts and philosophy).

Many of Brito's important achievements as Scientific Director of FAPESP were highlighted by the coauthors of this volume. The ones to whom he has delegated the job of helping him promote the advancement of social sciences and humanities are able and obliged to highlight his unconditional commitment to the humanist conception of the mission of FAPESP. And we are able and obliged to testify that making this commitment effective was not always an easy task for him. As a matter of fact, among the personal virtues that most contributed to his undeniable success as Scientific Director of FAPESP we must count the rare and difficult balance between humanism and pragmatism, which is as rare and difficult to maintain as our research system is complex, as are the multifarious values and interests of the society that it is meant to serve.

Adjunct Panel (CAD)
Special Programs and Collaboration in Research

FROM REGIONAL TO GLOBAL PLAYER

Euclides de Mesquita Neto

Introduction

This is to some extent a personalized account about how I have experienced the rise of FAPESP from being an important and efficient regional research funding agency to a global player among the largest research funding agencies in the world.

If the reader looks at the two figures included in this communication, namely the amount of resources that FAPESP invested in supporting international relations and collaborations (*Figure 1*) in the period of 1992 and 2017 as well as the map showing the countries and entities that have formal institutional agreements with FAPESP as of 2019 (*see the Map of FAPESP's Partnerships and Agreements in Brazil and Abroad at the end of this book*), the statement made in the first paragraph becomes self-evident.

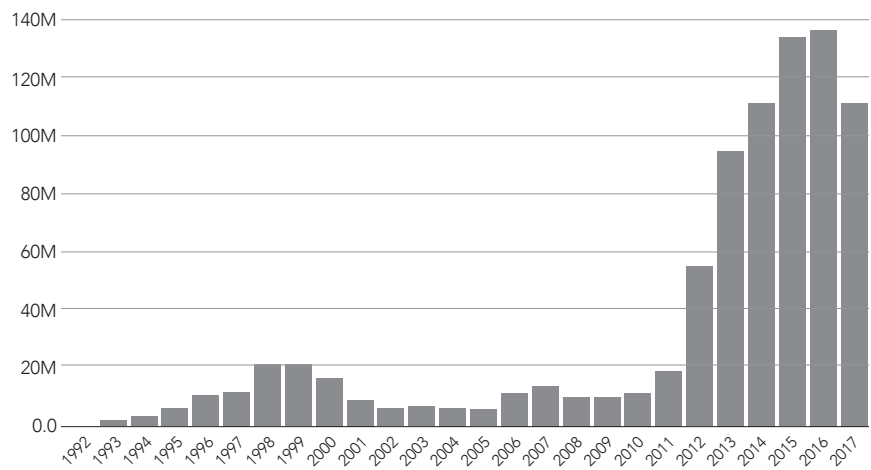
Nevertheless, a few aspects should be highlighted. It is no coincidence that the increase of expenditures in international collaborations has increased significantly in the last 15 years. This is clearly the result of an explicit policy followed by FAPESP Scientific Director of the period, Prof. Carlos Henrique de Brito Cruz. It is based on the assumptions that the collaboration with international partners allows the scientists from the State of São Paulo to tackle more challenging, more costly and riskfull projects. Interacting with other scientists worldwide allows the scientists

from São Paulo to show the quality of the science being produced in São Paulo research Institutions and Universities. It also allows São Paulo research community to be aware of the cutting-edge science being produced around the world and to better educate the future scientists of São Paulo and Brasil. It has an underlying implicit assumption that science, research, technology and innovation may play a significant role upon the quality of life of the São Paulo and Brazilian citizens.

What is not self-evident

Although figures 1 and the map give a clear indication that international collaboration has been a strategic policy for FAPESP in the last 15 years, there are many aspects which are not self-evident. The mentioned figures are only a representation of a much larger organized effort to support the researchers of the State of São Paulo in their task of advancing knowledge, science, research and innovation. Once the strategic course had been settled, a large number of qualified staff

Figure 1: FAPESP Total Expenditures in International Collaboration (1992-2017) (R$)



and a good management strategy was and is required to implement the outlined vision. I understand that the implemented management scheme has been a successful endeavor.

FAPESP has built a network of collaborations with many Universities, Research Institutions and Fundind Agencies throughout the world. These many institutions have their own programs and strategies. There is a big challenge in building a network of international collaborations within this very varied and disctinct landscape of institutions. But FAPESP has managed to accomplish this task based on a simple yet key idea: FAPESP funds research based on the principle of excellence. This is the underlying concept that allowed this research funding agency to cope with the many funding schemes and strategies of the international partners. FAPESP has tried to accommodate details of the specific programs and partners, but will not yield in the requisite of excellence for the funded projects and initiatives.

The pursue of funding excellence in research has not been a strategy, this has been an underlying and guiding principle and it has granted FAPESP the respect of largest and most prestigious international funding agencies, research institutions and universities worldwide. For instance, I can witness that it has been very uncomplicated to build a strong collaboration with the German Research Foundation (DGF). Funding excellence in its many dimensions has been a key issue for DFG and FAPESP, so that we frequently speak between us of both agencies as having 'similar DNAs'.

Some important events

It would be important to go beyond the description of general principles and to mention some important activities FAPESP has developed withing the framework of international collaboration.

- **The FAPESP WEEKs.** Starting in 2011, FAPESP organized 19

international symposia, taking qualified researchers from São Paulo to present their work and to be exposed to the work of qualified international researchers in Universities and Research Institutions around the world. These symposia are known as FAPESP WEEKs (FWs) and have been organized in many institutions in Europe, Asia and in the Americas. FAPESP WEEK has become a brand, and many partner institutions worldwide have been asking FAPESP to bring this event to their shores. The FWs have helped to disseminate and publicize the quality of the research being performed and also to built bridges and connections among the São Paulo based researchers and a large international community.

- **Regional Leader's Summit (RLS)**. FAPESP represents the State of São Paulo in the political and technical consortium that comprises seven states in various continents and is known as the Region Leader's Summit, or RLS. The partner states in the RLS Consortium are Bavaria in Germany, Shandong in China, Western Cappe in South Africa, Quebec in Canada, Georgia in the USA and São Paulo (FAPESP) in Brazil. The consortium has been working both, technically and politically. The technical interests of the RLS is concentrated in four main areas, namely, Aerospace and Aeronautics, Energy, Digitalization and Mini-satellites. FAPESP has a strong participation in this network, has had the presidency of the consortium for many years and has presently the vice-presidency. In 2019 FAPESP organized a major RLS event in the facilities of the INPE in São José dos Campos. The potential for increasing technical collaboration with the partner states is significant.

- **German-Brazilian Dialogue on Science, Research and Innovation.** The German House for Science and Innovation (DWIH- Deutsche Wissenschaft- und Innovationshaus) and

FAPESP have, regularly organized, with the participation of other sponsors, the so-called "German-Brazilian Dialogue on Science, Research and Innovation". The idea of the Dialogue is to bring German and Brazilian researchers to address topics which are currently relevant to german and brazilian society. The 8th Dialogue was organized in 2019 and addressed the topic "Radicalization and Violence: Perspectives and Prevention Approaches". The event has helped researchers from both societies to share their concerns and research results, as well as, to build bridges among researchers of both countries. This is a continuous effort that helps strengthen the ties between german and brazilian researchers.

- **The Global Research Council (GRC)**. Following a National Science Foundation (NSF) Seminar on Merit Review in 2012, the public research funding agencies present at the event founded the Global Research Council (GRC). This is a virtual entity, with the aim to share practices and experiences amongst its members. In the last 8 years the GRC has grown significantly and presently can be considered "the" entity that voices the jointly agreed principles and policies of the public research funding institutions worldwide. FAPESP has been participating on this endeavor since 2013 both in its Regional and Global Annual Meetings. In 2019 FAPESP hosted the Annual Meeting of the GRC in São Paulo. The event was attended by more than 50 Heads of Research Funding Agencies (HORCs) and FAPESP's Scientific Director was elected Chair of the GRC Governing Board. The event marked the consolidation of FAPESP as an important player in the international arena and opened the door for collaborations with many new funding agencies around the world.

- **Miryad.** The above-mentioned events are only a small fractions of the activities FAPESP has organized to promote the collaboration

of scientists and researchers based in São Paulo with partners around the world. There is a myriad of other activities that contribute to this purpose. It is not possible to detail these initiatives in a short paper, nevertheless, some like the SPEC – São Paulo Excellence Chair, the São Paulo School of Advanced Science (ESPCA), the BEPE Program, which allows all FAPESP fellowship receivers to spend part of the research time abroad, should be highlighted.

The Joke and the Challenges

In these last years, many of us around the Scientific Directorate have had the opportunity to talk in various international fora representing FAPESP and presenting its programs, views and strategies. Many of our presentations were based on data, slides and figures prepared by the Scientific Director. So, to a large extent, there was a consistency of vision and data in all presentations performed by FAPESP members attached to the Scientific Directorate. Some slides became famous and gave rise to the opportunity to make jokes about their content. This is the case of Map of FAPESP's Partnerships and Agreements in Brazil and Abroad, at the end of this book. When shown, the presenter, the Scientific Director and later many of us, would say the purpose of that slide was not that the audience should read all the names of FAPESP international partners, but just show that almost all the science in the world converges to FAPESP.

Apart from the joke, the Map gives a dimension of what has been accomplished by FAPESP in the last years in terms of international relations and collaborations. But it also shows part of the challenges ahead. There is still a lot to be done with respect to regions like Asia, Africa and Latin America. I understand that the next Scientific Director has a very good starting position to meet these challenges.

Adjunct Panel (CAD)
Special Programs and Collaboration in Research

DO BRITO

Hernan Chaimovich

Writing about Brito without being repetitive or laudatory is a complex challenge. Twenty years separate us, I am of an older generation, but Brito has always been a deep and mature thinker, so our relationship has been age-independent.

I met Brito more than twenty years ago when we were Research Chancellors at the UNICAMP, he, and USP, me. A long conversation at that time went through topics that still approach us, science, higher education, going through politics, and us.

In the intervenient years, we have been in contact with a few intervals. Brito became the Scientific Director of FAPESP in 2005. Because one of my colleagues had to resign his Coordinator position at the Foundation, Brito invited me to coordinate one of the significant Programs of FAPESP at the time. Being a Coordinator in FAPESP is intense, albeit not a full-time job. During those years, my contact with Brito was brief but intense.

After my formal retirement from the university, I spent a couple of years as the CEO of the Butantan Institute Foundation. Soon after leaving Butantan, I was hired by FAPESP, and, independent of the job description, I was an advisor to Brito and had for years the privilege of discussing with him often.

I left FAPESP for a couple of years to hold the Presidency of the

Brazilian Research Council, and, after that, I returned to FAPESP as an adjunct Coordinator, a place I hold today.

Years ago, my then very young daughter asked me what the job description for a Department Chair, a position I was occupying at the time, was. A reality-based answer is that real job descriptions for those jobs are inexistent and that it all depended on the willingness of the person holding that job to change the status of the organization he (or she) leads. This reminiscence refers to a Scientific Director that, like Brito, seems to dedicate more than twenty-four hours a day and a proportionate amount of time a year to his job. Unwillingly I have to concede, at the same time, that his efficiency borders my disturbing feeling that he only reads the first line of my emails, although, at the same time, I must recognize that even when I am sure of that, I am seldom right.

FAPESP is a unique organization recognized as such by similar institutions all over the world. In part, this is due to the quality of the scientists occupying the position of Scientific Directors since 1962.

One of the strategic goals of Brito's mandate was the internationalization of São Paulo's science and scientists through the science-policy implemented by FAPESP. FAPESP put into action by the carloads functional agreements with universities, research councils, companies, and multinational organizations all over the world. At one time, I asked Brito what the limit for these agreements was. His answer was, in a sense, Darwinian, i.e., those agreements that lead to real cooperation between scientists will prevail, the others will not. At the same time, it was clear that no umbrella agreements were to be signed if it was nor raining. The translation is that any deal had to be followed by some action between the parties. The federal Program of Science without Borders was helpful for this goal. For some years, FAPESP was flooded by international agents trying to make FAPESP an agency for student exchanges. It took time to explain that the Foundation was not

a travel but a research agency. Although some of the agents did not take this message well, many understood, and with them, FAPESP increased significantly international relationships.

Internationalization, however, is not a goal by itself. Brito has a clear view of the importance of enlarging the horizons of the São Paulo scientists. Scientists of this State must have international experience and global insertion if the quality of the science in the State is to be of world-class. At the same time, and because of this, the intellectual, social, and economic impact of the knowledge produced in São Paulo with FAPESP support should benefit the taxpayer of the State.

Reality weighs heavily in Brito's strategy. The members of the academy in public universities have only very recently recognized relations with the private sector as important. During Brito's mandate, FAPESP significantly increased cooperation with the private sector through research partnerships at the highest level with public institutions. These public/private research partnerships have considerably increased both financing and ambition of broad and long-term research challenges.

I have sketched here some of the significant strategic advances made by FAPESP under Brito's leadership based on my experience working with him. Of the many things unsaid, but clearly present in my view, is my admiration for Brito as a leader, scientist, communicator, diplomat, and human being. His caustic sense of humor, displayed openly in many instances, hides a very private person. Of outstanding culture, he reads unendingly and has a photographic memory, sometimes substantiated behind his endless Excel charts.

Adjunct Panel (CAD)
Special Programs and Collaboration in Research

NO COUNTRY FOR THE NEARSIGHTED

Luiz Nunes de Oliveira

'It is a kind of good deed to say well; and yet words are not deeds.'
William Shakespeare

The mission of the São Paulo Research Foundation, like a good playscript, affords various readings. With each Scientific Director comes an interpretation, but the history of FAPESP's success tells us how each new contribution was built upon legacy; no Director has yielded to the temptation of starting afresh and closing the doors to opportunity that predecessors had left ajar. And so it was with Brito, whose own legacy nonetheless portrays a pathbreaking construction of the mission.

My friendship with Brito dates from the 1980's, but being away from FAPESP and his team until three years ago, I watched from a distance as his plan unfolded, through the eyes of the research community, as it were. The community expected him to add new programs to the portfolio, but soon it became clear that the thrust of his actions would be to extend or improve existing ones with a view to raising the quality of research in the State, perhaps with a view to placing São Paulo among the scientific capitals of the world. While the distant target could only be perceived, the constructions aimed at it were visible, i.e., the revamping or reorienting of funding lines.

Many are the illustrative examples. Consider internationalization.

In certain circles, the word evokes feelings of triteness, so many are those who think of passport stamping as an end in itself. Brito, by contrast, envisioned a pry tool and applied it to leverage our research to a higher plateau. In private and in public, he has depicted international cooperation as a means to raise standards, identify challenging problems, nurture best practices, and show students that creative Science is within their reach – not the product of a few privileged minds that would wilt in the tropics. To bring his point home, FAPESP opened new lines to support cooperative research that were crafted to enhance those benefits: the São Paulo Excellence Chairs (SPEC), Special Project International Fellowships (BEPE), São Paulo Researchers in International Collaboration (SPRINT), and São Paulo Schools of Advanced Science (SPSAS) are variants of existing programs that were especially designed with those goals in mind.

The SPEC program, to dwell on but one, invites researchers with excellent achievement records to submit proposals and develop five-year research projects in local institutions. In view of their outstanding resumés, FAPESP opens an exception and allows the proponents of approved projects to travel repeatedly to their home bases in the five-year span, under the proviso that they spend twelve weeks per year, altogether, at the local institutions. The Presidents of the latter are thrilled to sponsor the stays of the visitors, so many are the benefits to the faculty and student body. Members of the academic staff argue with the visitors in seminar rooms. Post-doctoral fellows work shoulder to shoulder with them in the lab. Students have pizza with the authors of their textbooks. New ideas arise, and long-lasting ties are formed.

Other lines were adjusted to serve the central purpose. São Paulo is home to 20% of the Brazilian population, which in turn is only 3% of mankind. Clearly, in searches for bright minds, international pools offer much better odds than local samplings. Brito has urged grant awardees to post available positions on reputed announcement sites, and at the

same time worked hard to raise FAPESP's international prominence. Two of the most visible results of the combined effort are the mounting number of post-doctoral researchers with foreign passports and the benefits their work has brought to the research system.

The international prominence has attracted the attention of numerous funding agencies from numerous time zones. The resulting agreements led to joint calls for proposals that now make up long lists on FAPESP's home page. More than allowing for transnational cooperation, the joint calls often present unusual challenges to our research community. The interested researchers are faced with problems outside the scope of their traditional expertise, which call for bold new ideas, new insights, or unusual approaches.

Cooperation, we can see, is the pry tool Brito envisioned. To demonstrate that cooperation with industry or public offices can be equally fruitful, he devised the Engineering Research Centers (ERC's). In its essence, this funding line brings together members of two separate research communities. One is fluent in basic science and the other has access to complex, concrete problems. The ERC's purport to apply basic-science methods to such problems; again, bold new ideas, insights, or even paradigm shifts may be required. Arguably, the ERC's constitute the most effective tool among the instruments Brito has designed in his campaign to raise the quality of research. The spirit of the program is best captured by a statement from one of the participating companies: "We are not interested in incremental research." No pain, no gain.

Many were the changes in the portfolio, and FAPESP's inner gears had to spin faster to accommodate them. Quantitatively, the growth was not breathtaking. According to its 2004 Annual Report, the Foundation received 13,846 applications and awarded a total of 8,285 research grants and fellowships in that year. The two numbers grew gradually and are currently around 26,000 and 11,000, respectively. Early in the tenure, however, the broad diversification of the portfolio applied

substantial pressure on the proposal-review system. The system was able to absorb the stress because, by the time the blow struck, Brito's team had restructured the evaluation workflow. Not from scratch; instead, the new system was built upon the previous one (we can see a pattern: recall that the portfolio had also been expanded on the basis of inherited programs). Brito expanded the review panels, reinforced the hierarchy of the management structure, created regulations, added a 'Talk to FAPESP' tab to the home page to open a communication channel with the community, and insured that every important decision would come to his desk. To be brief, suffice it to say that, notwithstanding the enormously grown complexity of the operation, the turnaround time is shorter today than it was fifteen years ago.

Brito's most famous virtue is the ability to see through fog. Supported by solid mathematical background, he spots patterns in seemingly chaotic pictures. Certain conclusions to which his essays come are subsequently chimed in academic circles and the media. His, for instance, is the notion that the success of funding agencies should be measured by the scientific, social, and economic impacts of their grants. The same concept has now been adopted by funding organizations around the world. Another example: last month, after examining a substantial amount of data, Brito published the conclusion that the level of cooperation between universities and industry in Brazil is comparable to that in the US. A week ago, simultaneous editorials from the most influential Brazilian newspapers heralded this finding as evidence of a quiet revolution, even though the data had been on web pages for several years.

Proficiency in pattern recognition is not a common skill, but Brito possesses a more valuable virtue: vision, the farsightedness that has driven the São Paulo research complex *ad astra* and constitutes his legacy to FAPESP. Brito's vision will outlast its tangible consequences, like Shakespeare's quotation outlasts the most brilliant performances of *Henry VIII*. Thanks to him, generations of students may understand that

the purpose of research is not to solve practical problems, but to make us wiser; given sufficient wisdom, we will eventually solve the practical problem. Inspiration will come from the examples he has provided, and lives will be changed. No small achievement.

I have a personal debt of gratitude to the Scientific Director for inviting me to join the band of brothers and sisters who propped his deed. For the resulting, bonding friendships with team and staff members; the lunches at Deola and postprandrial laughs around the coffee machine; the joy of discussing fresh scientific discoveries; the thrill of drawing conclusions from scientometrics; the explicit criticism; the clever irony; the insight; the relentless, contagious enthusiasm. For three years of excitement, thank you, Brito.

Adjunct Panel (CAD)
Multi-user Equipments

A NEW POLICY FOR SHARING RESEARCH EQUIPMENT

José A. Brum, Watson Loh

FAPESP established a special program for dealing with multi-user equipment (EMU) in July 2013, when Prof. Brito created the Adjunct Coordination for Multi-User Equipment (EMU) inviting one of us (JAB) to act as its first member, replaced in July 2016 by the other of us (WL). The aim of this initiative was to format and deepen FAPESP's efforts in recent years to establish a park of EMU for research in the State of São Paulo.

FAPESP identified the importance of EMU back in 1999, when it started a strategic activity in this direction. At that time, most of the EMU were obtained through regular grant proposals. This model of funding changed in 2004, with the first specific call for EMU proposals that allowed mapping of the main needs for equipment in the scientific community. From 2005 to 2009, the EMU were supported essentially by this call. Under Brito's direction, a second call took place in 2009, allowing funds for EMU from 2011 to 2014. In this second call, the priority was to fund EMU in institutionally operated and openly supported facilities. It established a clear commitment to matching investment by partner institutions, and new guidelines to facilitate the access of external community to EMU. It is fair to say that this second call established a clear policy favoring the sharing of scientific equipment for the community which was paramount in consolidating new open research facilities in the State of São Paulo.

In 2014, FAPESP changed its strategy regarding EMU. Essentially, requests for medium to large equipment in Thematic and Young Investigator grants, when scientifically well justified and with potential to benefit external researchers, has been granted separately as EMU. Whenever possible, there was a strong emphasis on placing the equipment in existing institutional open facilities.

The importance that FAPESP attached to the development of EMU can be measured by the amount invested. The 2009 call alone was responsible for an average of R$ 30 million per year in the period 2010-14, and recent investment in EMU is holding steady at around R$ 50 million per year. Around 700 units of equipment are currently funded under this program.

When the Adjunct Coordination for Multi-User Equipment was established, the main concepts for the EMU effort were already in place, based on the requirements of the 2009 call and extended when necessary. They could be summarized by the following requisites: a) an adequate physical infrastructure provided by the host institution, b) technical personnel provided by the host institution to guarantee the operation of the equipment and assistance to users, c) maintenance of the equipment in perfect conditions by the host institution for a period of at least seven years, d) the establishment of clear rules and procedures for access to the equipment by the research community, e) the establishment of a Users' Committee, and f) a web page to facilitate access by the research community, including all relevant information for the equipment and its access. The Adjunct Coordination became responsible for implementing these guidelines and for follow-up these guidelines with regard to existing and future EMU, and for providing a suitably designed platform to improve the relationship between FAPESP and the scientific community. In this direction, a new tool has recently been implemented within the FAPESP Virtual Library (BV) to facilitate access to equipment classified by type and purpose (available at https://

bv.fapesp.br/pt/111/equipamentos-multiusuarios-emu).

A sequence of workshops were organized on EMU, the first in 2014 and the second in 2016, and a third is scheduled to take place in 2020, to deep the understanding of the EMU concept within the community and bring international experience to this discussion. The first workshop focused mainly on three issues: i) how to organize a multi-user laboratory, ii) the different strategies of open facilities and research laboratories as hosting EMU, and iii) how to promote the facilities as the right place for EMU. The second workshop addressed the roles of the different types of EMU frameworks, with special attention to the process of accounting and operational funding. These topics should be expanded and updated in the next workshop.

The scientific community responded positively and with great enthusiasm to FAPESP's efforts to develop a park of EMU in the State of São Paulo. It was clear that with the sophistication of research equipment, only though a sharing a policy for research equipment could assure proper funding for science in São Paulo. There was a significant effort in developing new facilities within the institutions to host EMU. These facilities are now able to offer sophisticated equipment and technical support to users, allowing a large community to benefit from the new capabilities and developing a wide variety of research projects. These facilities are probably the paradigm for the strategy of developing a large park of EMU base in São Paulo, and continued efforts to increase their number and to consolidate the existing ones. They should be the optimal locations to install the new EMU granted. Nonetheless, many equipment are installed in stand-alone research laboratories. Those are, in general, quipment mostly dedicated to specific research projects but open to users who comply with the EMU guidelines. It is gratifying to observe the effort and creativity of the researchers and institutions to develop mechanisms to facilitate the sharing of these equipment. In particular, the recent development of virtual EMU networks within universities in

the State of São Paulo, associating the facilities and research laboratories that host shared equipment, shows a great improvement in the access by the community to a large gamma of sophisticated equipments and also optimizing technical and financial resources.

Research is increasingly becoming more and more sophisticated, demanding expensive and complex equipment. High-quality technical support is fundamental for optimal use of equipment. The only way to guarantee up-to-date research capabilities for the scientific community of São Paulo is to formulate equipment sharing policies that promote EMU facilities in their more diverse frameworks of organization. FAPESP has been fundamental to the development of EMU concepts, as well as execution, proper funding, and integration of the institutions of São Paulo in a common effort. During his tenure as FAPESP's Scientific Director, Brito was responsible for establishing a strong program with clear concepts and guidelines for EMU program. With the concomitant initiatives undertaken by institutions in the state, this effort has been fundamental to establish a complex and complementary EMU base and develop a new culture in the scientific community regarding the shared use of these facilities. This in turn guarantees the responsible use of public funds and the availability of a competitive equipment base to support the state's leading position in research.

SÃO PAULO RESEARCH FOUNDATION (FAPESP)

Special Programs Committees

BIOEN Program

BIOTA-FAPESP Program

eScience Program

Program Evaluation

Research Program on Global Climate Change (RPGCC)

Special Program
BIOEN

A MILESTONE FOR THE BIOENERGY SCIENTIFIC COMMUNITY

Glaucia Mendes Souza, Heitor Cantarella, Luis Cassinelli, Luiz Augusto Horta Nogueira, Rubens Maciel Filho

Professor Brito is the creator of the FAPESP Bioenergy Research Program BIOEN. This was a milestone for the Bioenergy scientific community and a decisive step towards the creation of a robust State of São Paulo network of research that now includes collaborators across the world, today among the leaders in establishing sustainable development with renewable biomass. This is a complex field that demands knowledge on our energy matrix, local and global resources, technology efficiency and costs, the impact to our environment, the benefits to our society and the relevant role Brazil plays in this context.

Professor Brito is knowledgeable in all matters concerning bioenergy. He has a brilliant mind. He is able to move and act with great naturalness and depth of knowledge in many fields. His insight and persuasive power stimulated Brazilian and foreign researchers in their activities and made them believe in the power of knowledge as a transforming agent.

He is very keen on the value of fundamental sciences but is also full time on in transforming ideas into activities that can drive this field into innovation. His brain operates in the Pasteur Quadrant top right corner. He made clear for us that, at least with regards to BIOEN, knowledge

must be tied to action. The many examples of technologies applied in the industry that were developed in State of São Paulo university bioenergy labs are a testament to the success of his efforts.

Professor Brito launched the BIOEN Program as it is seen today, with its five Divisions, in 2009. The value proposition of BIOEN was to be a reference of state-of-the art renewable fuels and bioproducts research. BIOEN galvanized the community, attracting researchers from many fields of knowledge to engage in the challenges of sustainably producing biomass, biofuels and bioproducts. We have now 25 FAPESP areas of knowledge represented in the BIOEN Program, with over 400 researchers, 30 company partners and more than 1,300 published articles. He saw the need for a dedicated reference meeting and supported the creation of BBEST, the Brazilian Bioenergy Science and Technology Conference. This is now considered possibly the most important international bioenergy conference.

In parallel, he also organized the Global Climate Change Program (PFPMCG) and furthered the activities of the BIOTA Program. By 2012, at Rio+20, he organized a session with the three FAPESP Programs. It became evident what a tour de force they could jointly be.

Perhaps one of the greatest achievements of the BIOEN Program was the publication of a global assessment of bioenergy sustainability jointly led by BIOEN, BIOTA and Climate Change. The debates that led to the 779-page report produced under the aegis of SCOPE (Scientific Committee of Problems of the Environment) were kicked-off at UNESCO in Paris after a brilliant keynote address by Prof. Brito. The book had contributions of 154 researchers from 31 countries. The tome is now considered the Bible of Bioenergy having hit over 60 thousand downloads. Professor Brito is a great Champion of the results of this effort. He participated as an author, was engaged in the launching of the results in Brazil, at the World Bank in the USA and in the EU, and whenever applicable would praise the community for increasing globally

the impacts of brazilian research and making the extra effort to transform science into policy. He is very skilled in transforming scientific findings into information that can benefit the larger community. Through his efforts BIOEN now sits in many tables where high decisions are made and contributes to the activities of the International Energy Agency, the Global Bioenergy Partnership, the IPCC, the Mission Innovation and the Biofuture Plataform, among others. Under his leadership the State of São Paulo bioenergy community found a home at FAPESP to organize activities that led to the creation of the State of São Paulo Bioenergy Research Centers at USP, UNICAMP, UNESP, the creation of the Bioenergy PhD Program, the National Institute of Science and Technology of Bioethanol, two FAPESP Engineering Centers and research in 169 RISBs (Research in Small Business).

It is important to note that we had to work relentlessly to meet his very high standards. It was not unusual for him to call a meeting on the first week of January with hand-picked investigators where he would present a challenge and actions needed to make biofuels thrive. His continuous pursuit of excellence set the bar very high for every step in the development of BIOEN. When the groundwork needed to be done for deconstructing biomass he established many large initiatives in partnership with the industry. When we needed to access the best possible collaborators to sequence the sugarcane genome he said "bring them here". When bioenergy was under attack, despite scientific evidence of all its potential benefits, he pushed the community to better dissemination of our knowledge. If an area of research was not publishing in the top-tier journals he would come up with the numbers (he always had the proper statistics to support his views, which makes it difficult to argue against them) and provoke strategies to improve the international exposure of research.

A remarkable impression that Professor Brito leaves is his commitment with the effectiveness of our results in BIOEN, fostering

high quality papers, not just to expand the Brazilian contribution to science and technology, but actually to aid the decision making process in all levels so that we can achieve a more sustainable future, in a broad sense.

The State of São Paulo, and its bourgeoning bioenergy scientific community are privileged to have such an outstanding member in our midst. Having had the honor of his leadership and guidance at FAPESP we members of the BIOEN Coordination Committee would like to sincerely thank him.

Special Program
BIOTA-FAPESP

THE BIOTA-FAPESP PROGRAM UNDER THE LEADERSHIP OF PROF. BRITO AS FAPESP'S SCIENTIFIC DIRECTOR

BIOTA-FAPESP Program Steering Committee

Over the past 12 years, Brito's continuous and firm support was undoubtedly essential for the BIOTA to project itself nationally and internationally. The Program has become an international reference in the area of research on the characterization, conservation, restoration and sustainable use of the very rich Brazilian biodiversity, and an important player in the improvement of policies both in the State of São Paulo and in multilateral organizations such as the Intergovernmental Biodiversity Platform and Ecosystem Services/IPBES.

Due to FAPESP's policy, implemented by Brito, all the parameters to evaluate the internationalization of an initiative grew substantially in the Projects linked to the BIOTA-FAPESP Program. The Program established partnerships with foreigner research agencies, such as NSF/US, NERC/UK and NOW/Netherlands, with multilateral research organizations like the Belmont Forum and BIOdiversa/EU, and the number of project with the participation of foreigners' experts more than duplicate over the last decade.

More recently, Brito's leadership and vision of science allowed the BIOTA Program to make joint calls with federal and state administration bodies, aiming at using the advances in knowledge lead by the Program

to improve public policies for the management and sustainable use of biodiversity and ecosystem services.

My first experience to work with Brito was in 1996, when he was Dean of Research, and I was taking over the Dean of Graduate Studies at UNICAMP. But after the term ended, we had little contact, until he took over FAPESP's DC and invited me to resume the BIOTA-FAPESP Program Coordination, in the end of 2008.

Along these 12 years not always we were of the same opinion, but whenever this happened Brito was always open minded to discuss the problem and the final decision was always in the best interest of FAPESP. I have learned a lot with his experience and vision of science, and certainly the BIOTA-FAPESP Program benefited from his strong leadership as Scientific Director.

So I have only to thank Brito for calling me to resume the Coordination of the BIOTA-FAPESP Program, and give the Steering Committee all the support to transform it in a model for the other Research Programs established during his term.

Carlos Alfredo Joly

It is a great pleasure for me, as a researcher of the BIOTA-FAPESP since its creation in 1999, and now, as a member of the Steering Committee and more recently also in the Board of Trustees of FAPESP, to say some words about Professor Carlos Henrique de Brito Cruz. I have been more close to him as Scientific Director, because I have big projects in the BIOTA, which I consider the most important research program on biodiversity in Brazil and, maybe in the world in these last 20 years.

During these 15 years I have been very impressed with Brito's deep scientific vision, excellence as manager and human person, and as head of the most important funding agency for research in Brazil. I believe he printed an own style at FAPESP, always concentrated on the excellence of basic science, he was in our defense during the 15 years he was director. Sometimes even looking a "tough person," I would like to highlight here his human and collaborative side that I consider fundamental to a great manager of an important grant support Agency. In 2011, during the celebration of the International Year of Chemistry IYC-2011, I was in the international committee, as representative of SBQ/IUPAC. I submitted to FAPESP a project "São Paulo Advanced School on Chemistry – Natural Products, Medicinal Chemistry and Organic Synthesis Integrated Solutions for Tomorrow's World" a Nobel Prize ESPCA, quite unusual event at that time. I had the project and all docs to the submission to FAPESP. However, due to an emergency to take my husband already very sick to the hospital, I didn't send the project, and only at afternoon, a driver took the project to FAPESP. It takes 3 hours from Araraquara to São Paulo, and the project arrived at FAPESP after 5 PM and due to great collaborative sense of the scientific director Brito Crito Cruz the process went to merit evaluation, and we had 4 Nobel approved. His sense and sensitivity permitted this ESPCA of great international success. Maybe one of the most important ESPCA, with more than 150 worldwide young scientists. It was an advanced school also supported by SBQ, ACS, RSC, IUPAC in celebration of IYC-2011. Also, ahead of his time, Brito supported a beautiful event at FAPESP on IYC-2011, with important support of Mariluce Moura, at that time Director of *Pesquisa FAPESP* magazine. We made a monthly scientific event with renowned scientists of different knowledge areas, aimed at public high school in São Paulo. It was exciting, and we had several good fruits of this action. Five students from that time correspond with me until today. They are highly distinguished professionals today

as engineers, educators and biologists. Recently, as a FAPESP Board of Trustees member, it has been an enormous privilege to share some ideas with Brito, always committed in find solutions to global problems based on good science and how we can get a better future based on knowledge. I have been glad with his performance, in all meetings.

Vanderlan Bolzani

I have been invited by Prof. Brito to join the BIOTA Program Steering Committee in 2009. Prof. Brito has fully supported the BIOTA Program and has also stimulated its internationalization by numerous join calls with international agencies and support to host post-docs and senior scientists from other countries. Despite the current challenges concerning science and education, FAPESP continued to be a model for research funding both nationally and internationally with Prof. Brito as its Scientific Director. It has been a pleasure and an honour for me to work with him along these years.

Luciano Martins Verdade

I was invited by Professor Brito Cruz to join the BIOTA-FAPESP steering committee in 2009, in order to promote the science of biodiversity and of biodiscovery. It was an honor and pleasant task to join a team of notorious researchers headed by Prof. Carlos Joly, and including Profs. Vanderlan Bolzani, Luciano Verdade and Mariana C. de Oliveira, and more recently Profs. Simone Vieira and Jean-Paul Metzger. Together we fostered several initiatives under FAPESP auspices and supported by Prof. Brito Cruz, including workshops, meetings,

the BIOTA-EDUCAÇÃO venue as well as three BIOTA-FAPESP evaluation meetings. During the 15 years period under the direction of Prof. Brito Cruz, FAPESP also participated as a partner in several national Biodiversity/Biodiscovery initiatives promoted by the federal agencies CNPq and CAPES, including the SISBIOTA-Brasil program, the REPLORA program and the PELD program. The BIOTA-FAPESP program participated actively in these initiatives.

It was an intense period of learning how to promote science policy based on science. I am particularly grateful to Prof. Brito for the opportunity to participate in the BIOTA-FAPESP steering committee during his term as the FAPESP scientific director.

Roberto Gomes de Souza Berlinck

Despite the short contact I had with Prof. Brito during this last year, since I joined the BIOTA-FAPESP steering committee, I could quickly notice some of the qualities that made him an excellent scientific director: his sensitivity with the particularities of different research fields, the speed in understanding the problems that were presented, and in proposing possible solutions, his inexhaustible work capacity (answering all e-mails, regardless of the day of the week or the time), and his enormous capacity of articulation, inside and outside the academic arena. No doubt a great part of Fapesp's advances in recent years has been driven by the scope and pertinence of its scientific director's vision. In particular, Prof. Brito has always supported the expansion and constant improvement of the BIOTA-FAPESP Program, including the creation of the Biota Research and Synthesis Center (the BIOTA SYNTHESIS). Thanks a lot!

Jean Paul Metzger

I have been a part of BIOTA program Steering Committee since the beginning of 2019. I have always admired the BIOTA program and Prof. Brito's work as Scientific Director of FAPESP, and I was very delighted when he invited me to join the program. In this short time I could experience his dedication to FAPESP and his open-minded attitude towards our demands, always supporting the BIOTA program national and international initiative. I would like to thank for the opportunity to take part of this time, best wishes.

Simone A. Vieira

Special Program
eScience

"GOOD IDEA, BRING ME FACTS"

Claudia Bauzer Medeiros

You dont lead by pointing and telling people some place to go.
You lead by going to that place and making a case
(Ken Kesey, american novelist)

A few months after Brito became Scientific Director, he called me (...weeeell... he sent me an email at 3 a.m.) to say that he was assigning me to the new Panel for Computer Science and Engineering (CS&E) at FAPESP. He was splitting the then Mathematics, Statistics and Computer Science Panel – in which I sat as the Computer Science expert – into two separate panels. His reasoning: research efforts in all fields increasingly depended on computing, and he thus foresaw a progressive increase in CS&E proposals, and the appearance of new related research fields. Moreover, he had been collecting statistics on proposals, which showed that the number of computing projects submitted every month to FAPESP was comparable to those in, e.g., Physics, or Chemistry – both of which had separate full-fledged Panels.

This story, to me, is representative of his work style – he combines his vision(s) of the future of research with fact-based decision making. Yes, he is a visionary – and how! – but his actions are based on concrete data, not on good hunches.

That decision had many good side effects: for instance, increasing

the awareness of Computer Science as a research field per se – as opposed to a provider of software tools and hardware infrastructure. Moreover, not only was there a continuous growth in the number of quality proposals (as forecasted by him), but having a dedicated Panel allowed us to start discerning patterns in CS&E submissions. So it was that, in 2009, the Panel went to Brito with a request: FAPESP should create a research program to foster interdisciplinary research involving CS&E. "Good idea, bring me facts", he said (why were we not surprised?). Thus was the eScience program born in 2013 – but only after 2 workshops involving scientists from several domains, reports, re-re-revised proposals, and many, many meetings with him, in which he continued to pose unanswerable questions. Though frustrating at the time, this collective program gestation process was fundamental to the subsequent success of the eScience program, and its evolution, with time, into "eScience and Data Science".

That program paved the way for FAPESP's Open Data policies, embraced by him. Thanks to his encouragement and prompting, the public universities of the state of São Paulo undertook a pioneer initiative in Latin America. They united efforts to create the first state-wide network of open research data repositories, which required from all institutions extensive planning, and large technical, training and administrative efforts. Launched in december 2019, it will help foster new kinds of scientific collaboration between scientists from São Paulo and from the rest of the world, and advance knowledge through data sharing and reuse.

These are just 3 instances of how, through his foresight in planning, long term initiatives came to life that will continue to bear fruit way beyond his mandate. And Brito is not "just" a visionaire who asks questions and requests facts. He is passionate about research as a means to change the world, and the power of appropriately educating young people. And always, in any discussion about funding alternatives, he will

stress his respect for the taxpayers of the State of São Paulo, and how FAPESP has to give back value for what it receives – in research and innovation.

And yes, there are countless anecdotes of our meetings at FAPESP, and of ensuing discussions, and endless email messages. He and us often got frustrated – why not? – but also felt happiness and a sense of accomplishment.

To finish, yet another story: back in 2003, Brito was the President of the University of Campinas, where I teach. A first year undergraduate student told me "I did not like today's lunch at the cafeteria, so I emailed a complaint to President Brito." I was flabbergasted "He will never answer, he is too busy!" To which the student replied "Well, he answered from his personal email address that he would check and get back to me." One week later, the student reported that the University's chief dietitian had sent him a detailed answer, explaining how cafeteria food was prepared, considering nutrition, cost, and seasonal products. "That is great" he said; "I was listened to. I still have issues with the food, but at least I know what is happening."

This anecdote complements, through facts, yet another facet of Brito's management style – listening to complaints and making sure everyone gets an answer, provided by someone who is competent on the related field.

Special Program
Program Evaluation

IMPACT EVALUATION: ACCOUNTABILITY, PLANNING AND ADVOCACY IN FAPESP

Sergio Luiz Monteiro Salles Filho

A remarkable characteristic of Professor Brito Cruz is his continuous search for data and evidences in order to support his decisions. He is impressively dedicated to get as much (good) information as possible in order to make the best possible decisions.

One could say that this is just an expectable trait of good researchers and good managers, but in his case, it is much more than this. When he suspect some evidences in a given subject – even when broadly diffused and accepted - are too poor or does not convince himself properly, then he goes deepen into data looking for details in a way nobody else had done before.

Not-rarely, he finds new evidences that change the perception of experts – and also of the general public. Just to mention two examples, he made clear the actual figures about how big is the investment of industry in research universities around the world, dismissing the common sense that it should be bigger than it really is, he also pointed out how much cooperation between companies and universities has really increased in Brazil in the past 15 years or so: much beyond that showed by figures commonly presented in the literature. These two simple examples helped changing the perception about the role and the connection of research universities in Brazil.

Being so interested in generating evidences, Prof. Brito Cruz, since his first moment as Scientific Director of FAPESP created and implemented several initiatives for generating and using quantitative and qualitative data to support decisions and to plan FAPESP's investments.

I believe his main concern in this matter has been that of making decisions based on evidences in order to increase the return of FAPESP's investments to the society. As is now widely recognized, funding agencies must measure their impacts not only to show that their instruments fund good research, but also that their impacts over societal indicators are positives.

As time passed, professor Brito Cruz's initiatives proved not only to be very useful for increasing the efficiency and effectiveness of FAPESP, but also as a source of information for the accountability and the political advocacy of the importance of public funding for science, technology and innovation (STI).

It was exactly in order to measure the effects of its investments that FAPESP started systematic activities on impact evaluation in 2007. Since then, several programs have been evaluated and a specific Coordination on Impact Evaluation was created (www.fapesp.br/evaluation).

Impact evaluation at FAPESP has focused on multidimensional approach, employing quantitative and qualitative indicators to measure multiple dimensions, as for scientific, technological, economic, and social.

Multidimensional impact evaluation is particularly challenging for it needs to answer questions of different natures using different sources of data and methods of analysis. Besides, being a diversified funding agency, FAPESP must measure its impacts over a wide range of financing instruments: basic research, applied research in companies, research and innovation in cooperation between research organizations and companies, scholarships, innovation in public policy, young careers, thematic oriented programs, international cooperation, consortia of

multiple organizations for R&D and innovation, just to mention the most regular ones.

To cope with this challenge FAPESP has sought to answer questions as for instance: does FAPESP's peer-reviewed based evaluation increases the scientific and technological impact of scholarships? What is the benefit/cost relationship of Small Business research funding at PIPE Program? Funding small business really increases companies' capacity to perform more R&D? Are there any important differences funding projects under structured thematic programs compared to projects in the same field funded without such organization? International collaboration is more effective under formal cooperation between national and foreign institutions? To which extent scholarships are fundamental to increase scientific relevance? What to expect from young-researchers funded by FAPESP that are temporarily employed in non-traditional universities located out of the main regional research centers?

These and other questions have been addressed and answered by FAPESP since prof. Brito Cruz started implementing impact evaluation at the institutional level.

Just to give a taste about the evidences FAPESP has generated through impact studies, we could summarize the main answers to the above questions as follows:

- Yes, peer-reviewed based system makes difference in terms of scientific production when compared to non-peer-reviewed systems, particularly for ex-holders of PhD scholarships in a basis of more than 35%. It is also important to notice that this difference is higher in the first five years after completing the PhD.
- The benefit/cost relationship of funding small business research in tech-based companies is positive by 6 times, meaning that for every real applied by FAPESP the program returns 6 reais.
- PIPE has also been able to increase the willing of companies to

employ people in R&D activities. In a recent evaluation companies funded by PIPE increased their personnel in R&D in more than 110% compared to companies that submitted for PIPE but have not been funded.

- Projects funded by FAPESP under structured thematic programs – particularly in the BIOTA program case – have been able to increase their scientific production twice as much than projects in the same area performed outside the Program.
- International cooperation performed under formal institutional collaboration with foreign organizations has reached almost two times more impact - measured by number of citations of papers published in cooperation - than those achieved without institutional agreements.
- PhD candidates that are recipients of scholarships produce a scientific impact measured by citations 6,5 times as much the impact produced by the publications of candidates that did not received a scholarship.
- Finally, early-careers funded by FAPESP temporarily employed in non-traditional universities and located out of the main regional research centers were able to show the same performance - in some cases even better - those located in traditional universities and in the main regional research centers.

Thanks to the forward-looking of professor Brito Cruz, these and other findings have helped FAPESP in developing internal policies and in showing results for the STI community and for the society as a whole.

Of course, there is much ahead to be done, but his initiative anticipated a necessity that funding agencies are nowadays facing worldwide. FAPESP has pioneered impact evaluation and has atracted other agencies along, contributing for the development of science, technology and innovation in our country.

Special Program
Research Program on Global Climate Change (RPGCC)

SCIENCE FUNDING TO FIGHT CLIMATE CHANGE

Gilberto Câmara Neto, Gilberto de Martino Jannuzzi, Humberto Ribeiro da Rocha, Jean Pierre Henry Balbaud Ometto, Patrícia Morellato, Paulo Eduardo Artaxo Netto

Brazilian science in the field of global climate change has achieved tremendous progress in the past 15 years. Despite being of regional scope, FAPESP has played a vital role in this national advancement, substantially contributing to strengthen Brazilian leadership in the field. Brazil is now one of the countries presenting the largest scientific production in the southern hemisphere. Professor Brito's leadership and a number of clear, vigorous and sound actions made a real difference in enabling FAPESP to address this global challenge.

Believing in this possibility and creating mechanisms for the scientific community to advance on a solid foundation led to outstanding results. In all reports issued by the Intergovernmental Panel on Climate Change (IPCC), Brazil's contribution has always been very strong, centering on researchers in the State of São Paulo who collaborate with FAPESP.

Fifteen years ago, climate change science lacked the enormous visibility it has now. A short document proposing an initiative by FAPESP in this direction was produced based on a proposal envisaged by several senior researchers, including José Goldemberg, João Steiner, Carlos Nobre, Paulo Artaxo and Adolpho Melfi, among others. The document

was the inspiration FAPESP needed to create the Research Program on Global Climate Change (RPGCC), launched in 2008.

It is interesting to note that, in messages exchanged with researchers, Brito seemed to take a somewhat skeptical stance on climate science and always stressed the acute uncertainty associated with it. "We often received e-mails in which he would draw attention to the writings of skeptical scientists. We didn't really know what he meant by this", Artaxo recalls.

In a clear example of the demand for a serious, high quality and dense scientific production, the RPGCC advanced to the point of issuing its first call for proposals in 2008. It approved 21 Thematic Projects in various knowledge areas, all integrated with climate change. This was an emblematic historic moment, injecting enormous vigor into the production of climate change science in Brazil.

In favor of scientific quality and transparency, Brito always emphasized the need for interdisciplinarity, internationalization, and publication in high-impact journals. The projects approved by the RPGCC completely complied with these requirements, and, since then, funded researchers have produced many articles that ended up published in high-impact journals owned, for example, by Science and Nature publishing groups.

The RPGCC has always had a major international component. We have had many projects approved by bilateral agreements with the US Department of Energy (DoE), Research Councils UK (RCUK), the US National Science Foundation (NSF), the German Research Foundation (DFG), the French National Research Agency (ANR) and many other foreign research funding organizations.

FAPESP has also intensely participated in the multilateral scientific research-funding universe. An example is FAPESP's membership of the Belmont Forum, an international consortium comprising world's funders of research on environmental change, including interdisciplinary projects relating to global climate change both in a wide array of knowledge areas and on topics ranging from biodiversity to cities, oceans to mountains,

transition to sustainability to e-infrastructure, among others. FAPESP has issued calls for proposals in practically every opportunity the Belmont Forum offered, playing an active role in the consortium and bringing about major advances in internationalization and support for interdisciplinary research.

Global challenges, global actions. More recently, the RPGCC has featured in editions of FAPESP Week held in Argentina, China, France, Germany, Spain, the UK, the US and elsewhere, helping to highlight to excellence of the science done in the State of São Paulo.

On the home front, specific calls added new RPGCC projects that focused on physical aspects of climate change, its impacts, ecosystem vulnerabilities and mitigation measures. FAPESP has funded many projects in the past 15 years for research on Brazilian biomes, especially the Amazon Rainforest. Researchers of the State of São Paulo have discovered processes that have been incorporated into global climate models and contributed to the IPCC's reports. Much of the new meteorological knowledge used by weather forecasting models originated from projects funded by FAPESP, which have greatly improved this activity. Brito also recognized the importance of funding research infrastructure, supporting the acquisition of the oceanographic research vessel *Alpha Crucis* and the supercomputer *Tupã*, among other large-scale facilities.

So far, the RPGCC has supported more than 144 projects focusing on the impacts of global climate change via Regular Research Grants, Thematic Project Grants, Young Investigator Awards and the Research Partnership for Technological Innovation Program (PITE), as well as its several linked scholarships. This effort has resulted in over 300 published articles each year and intense collaboration among institutions in the State of São Paulo and among the leading universities and international laboratories. More than 80% of the articles published by the RPGCC have foreign co-authors.

Integration among FAPESP's programs is key for Brito. So the RPGCC has built strong links with the FAPESP Research Program on Biodiversity Characterization, Conservation, Restoration and Sustainable Use (BIOTA) and the FAPESP Bioenergy Research Program (BIOEN), including such cross-cutting projects as the Scientific Committee on Problems of the Environment (SCOPE) book *Bioenergy and Sustainability: bridging the gaps*, produced jointly by all three programs and coordinated by BIOEN. When FAPESP's programs work together, they drive innovation and creative science, with a significant impact on public policy.

Science communication and public policy are also important for Brito. He always stresses the strategic importance of scientific advancement, good publications and dissemination of knowledge to the society and, especially, to policymakers.

Brito's support and diligence have been fundamental for the RPGCC. Democratically but firmly, he points out the best ways to innovate, discussing with the steering committee and demonstrating his conviction that the impact of global climate change on society is significant and should be covered by our research.

The effects of global climate change are now increasingly clear and significant in the present, and there is a growing awareness of the need to develop methods and technologies to mitigate them. All this highlights the importance of Brito's broad vision as FAPESP's Scientific Director over the years. The members of the RPGCC are deeply grateful for this fruitful period under Brito, who has assured the outstanding development of climate change science in State of São Paulo.

SÃO PAULO RESEARCH FOUNDATION (FAPESP)

Scientific Directorate – Team

Advisors

Managers

Proposals & Follow up Management Team

Assistants

Scientific Directorate – Team Advisors

RESEARCH COLLABORATIONS AT FAPESP: HOW WE GOT THERE

Marilda Solon Teixiera Bottesi,
Renato Atílio Jorge

Besides paying much-deserved tribute to Professor Carlos Henrique de Brito Cruz for his outstanding 15-year record in FAPESP as Science Director, our intention here is to present a brief account of his role in spearheading the incredible growth of research collaboration opportunities for the State of São Paulo.

In 2005, when Brito took office as Science Director, FAPESP already offered some opportunities for researchers in the State of São Paulo to interact with colleagues worldwide. The Foundation also offered opportunities to bring scientists from abroad for short or long periods at local institutions, to take part in collaborative research projects. At that time, opportunities offered by FAPESP included regular funding lines, as Research Scholarships Abroad, Visiting Researcher Awards, New Frontiers Program (discontinued) and financial support for organization and participation in scientific meetings, which enabled researchers based in the State of São Paulo to travel abroad to exchange knowledge of research done locally and abroad.

Brito's Strategies

When it comes to international collaborations, the difference is overwhelming as we compare now and then. Back in 2005, FAPESP had only two agreements with foreign institutions. Nowadays, it has more than 390 agreements involving the State of São Paulo and 38 countries.

Believing that borders cannot limit knowledge or scientific production and that the more interaction the better the results, Brito and his team have worked extremely hard in these past 15 years to foster research collaboration with partners within Brazil and abroad, including higher education and research institutions, research funding agencies, companies and s multinational organizations. Thus, FAPESP has been encouraging research collaboration, both national and international, and contributing to the advancement of scientific and technological knowledge in the State of São Paulo, in Brazil and in the world.

Always emphasizing excellence, Brito's strategies for research collaboration aims, above all, to increase the social, economic and scientific impact of the science produced here, which makes São Paulo an internationally recognized research hub. Moreover, in fostering joint development of projects by researchers in São Paulo and elsewhere, it enables the resulting teams to achieve better results.

Regarding international partnerships, the aim has always been to ensure that researchers from the State of São Paulo led as many projects with foreign colleagues as possible, placing them in key governance positions in the context of their research groups, and offering opportunities for partnerships that stimulate the internationalization of startups.

Guided by Brito vision, FAPESP has implemented several strategies to foster research collaboration. One of them was the search for national and international counterparts to co-finance large projects and/or advanced equipment, facilitating the participation of researchers from

the State of São Paulo in these projects.

Another strategy promoted was the encouragement of bold, comprehensive projects, understanding that collaborative research involves far more than mere researcher mobility. Prof. Brito believed and stimulated the submission of complete research projects jointly designed, written and developed. These projects should preferably be long-term, internationally competitive and bearing advanced objectives.

A third strategy worth mentioning in establishing partnerships with research funding agencies within Brazil or abroad was the identification and comprehension of needs and demands of our partners, which enabled us to be flexible enough to bring benefits to the State of São Paulo and to Brazil.

Today the research conducted in São Paulo is internationally competitive and capable of attracting young overseas scientists who may ultimately be tenured by local research institutions, as well as senior researchers who can come to work as principal investigators in partnership with researchers based here.

New and enhanced funding lines for international collaborations

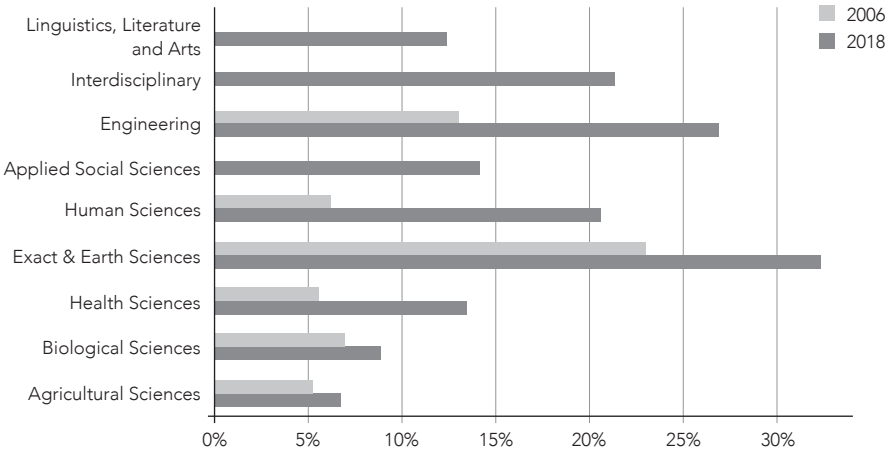
FAPESP has extended its regular funding lines to foster collaborative research during the course of the past 15 years as new funding modalities were created.

For this purpose, one of the first steps taken by Brito was to include complementary benefits in Regular Research Grants and to increase the ones in Thematic Project Grants. Complementary benefits are financial support added to the project's budget as a percentage of the original awarded funding. These actions boosted the diffusion of research and interaction with colleagues elsewhere.

One more initiative of great importance was to allow the inclusion of Postdoctoral Fellowships as an item within budget for Thematic

Project Grant and requiring international calls for selection of these fellows by the principal investigator. *Figure 1* shows the growth in numbers of foreign researchers in proportion to FAPESP's Postdoctoral Fellowship awardees.

FIGURE 1. Foreign graduates as a percentage of FAPESP's Postdoctoral Fellowship awardees



In 2009, FAPESP launched the program São Paulo School for Advanced Science (SPSAS) to bring to the State of São Paulo internationally renowned scientists to spend a week discussing topics on the knowledge frontier with local researchers and PhD students as well as from other parts of Brazil and even other countries.

Still as part of the internationalization policy led by Brito and considering the priority to support the short and medium-term research internships abroad, FAPESP created in 2012, the Research Internship Abroad Scholarship (acronym BEPE, in Portuguese), offered to FAPESP fellows of Scientific Initiation, Master's degree, PhD and Post-doctorate.

In 2014, two new funding modalities were created: the São Paulo Excellence Chair (SPEC) and the SPRINT Program. SPEC is, in fact, a Thematic Project in which the principal investigator must necessarily be a researcher from abroad leading here in São Paulo a research project, on topics at the frontier of knowledge, along with a local researcher. Differently from SPEC, the SPRINT Program focuses particularly on the exchange of researchers as well as small seminars. Selected SPRINT projects last up to two years. The partner is necessarily foreign and is usually a university, research institution or research funding agency.

Public and private synergy – some results

The private sector has also taken part in Brito's internationalization strategy. Besides the strong incentive of collaborative research with companies in the past 15 years, an important step was taken in 2012, allowing the co-financing of long-term projects (up to 10 years) for the development of world-class research at the frontier of knowledge, fundamental or application-oriented. The FAPESP Program of Engineering Research Centers (ERC) is a program in which one of the partners is a company that co-finances research and that is strongly motivated to participate in the definition of focal themes to be investigated, by actively participating in research projects and applying the obtained results. At present, FAPESP has already approved 14 centers. Two more centers are in the final stage of analysis. Investment reaches approximately 77 million dollars by companies.

One of the results is the significant growth of scientific articles written in co-authorship between researchers from higher education and research institutions in the State of São Paulo and researchers from companies elsewhere (*Figure 2*).

Cooperation agreements are not strictly indispensable to research collaboration. Experienced researchers also lead spontaneous initiatives

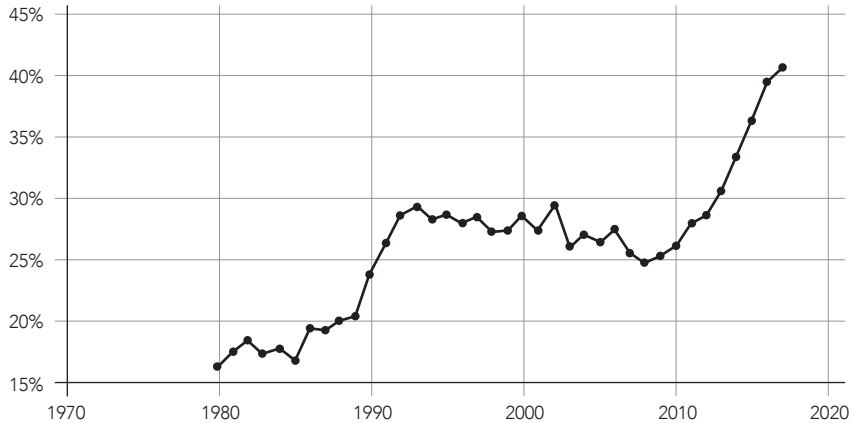
FIGURE 2. Publications by researchers from São Paulo in co-authorship with researchers from companies

and set out to find partners in other countries on their own. However, FAPESP understands that cooperation agreements increase the visibility of the opportunities for collaboration in the State of São Paulo and in the partner state or country. Furthermore, agreements and respective calls for proposals help to organize demands and, in most cases, guarantee the co-funding of selected collaborative research projects.

Since 2005, FAPESP has signed almost 400 agreements with multinational organizations, companies, higher education and research institutions, and funding agencies in Brazil and abroad. In more than 80%, at least one call for proposals has been launched and projects contracted. The map included in the last pages of this book shows all the cooperation agreements signed by FAPESP to date.

Figure 3 presents the vigorous growth since 2010 in the proportion of articles published by researchers based in the State of São Paulo in co-authorship with researchers based abroad. We believe that the FAPESP's research internationalization strategies strongly contributed to such progress.

FIGURE 3. Publications by researchers from São Paulo co-authored by international partners



Changes also come from within

To make all this possible it was necessary for the FAPESP's Scientific Directorate (SD) to establish new internal procedures and adapt those that were already in practice.

In 2006, while working on upgrades to SAGe, FAPESP's online project management system implemented in early 2005, we changed the SD's organizational structure, dividing its staff into teams by knowledge area to make grant management easier and ensure rigorous treatment of each step in the process. Previously, staff members used to be divided into two groups. Currently, there are five teams: Social Sciences and Humanities; Physics, Mathematics, Chemistry and Engineering; Life Sciences; Agronomy and Veterinary; and Research for Innovation. Each one is responsible for managing projects and interacting with their respective Area Panels and Adjunct Panels.

The Scientific Directorate enhanced its efficiency and efficacy with two other important initiatives. The first one was the considerable

increase of the amount of Area Panels members. The second was the creation a position called "Coordinator of Scientific Programs", one for each of the five areas listed above. They work with the respective teams of staff members, overseeing the analysis and processing of grant applications.

Such changes optimized the project management process and shortened the average time between proposal submission and notification of the researcher regarding the outcome of the analysis from more than 100 days in 2005 to 68 days in 2019.

This organizational structure, alongside the standardization of procedures, of which the introduction of the internal set of "Normative Instructions" by Brito is an example, enabled FAPESP to move forward with the signature of new cooperation agreements, issue more calls for proposals, and, consequently, support more collaborative research.

Professor Carlos Henrique de Brito Cruz, for all you have been doing for the scientific community in the State of São Paulo and your leadership in the Scientific Directorate, there are no words to express what a respect, honor and gratitude it has been to be part of your team. Thank you, Brito!

Scientific Directorate – Team Managers

BRITO CRUZ: A SCIENCE AMBASSADOR

Alexandre Roccatto, Ana Paula Yokosawa, Bruna Musa, Carolina Costa, Patrícia Tambourgi, Patrícia Tedeschi, Regina Lúcia Batista da Costa de Oliveira, Simone Godoi, Virginia Subiñas

Legacy is a powerful word. It gently intertwines past, present and future, and it is normally attributed to those who actually made a difference. This is true of Professor Carlos Henrique de Brito Cruz. We, the authors of the next few pages, have had the privilege of working with him, managing FAPESP's scientific programs and collaborations, both national and international. We would like to share some thoughts on Prof. Brito's legacy, first, on a broad view of his invaluable work and, then, on a more personal note, of lessons learned from him.

FAPESP and international relations: diplomacy for science

If someone were to ask us what is Brito's most important contribution, the first answer that would come to mind would be his successful work at making FAPESP one of the world's most prominent and respected scientific research funding agencies. It is true that his internal work on the development of the Foundation and towards more interconnection with other National research institutions is extremely relevant. However, in our view, the international projection he has articulated throughout his scientific leadership is his foremost legacy not only to the agency itself,

but also to the scientific community of the State of São Paulo and Brazil.

It is important to remember that science has not always been a relevant theme in international relations. Diplomacy advanced from the 20th century into the 21st bearing a changing role. It ranged from a dominating state-centred Clausewitzian perspective, in which war & peace themes prevailed, to a more contemporary view, in which institutions, subnational actors and international cooperation play a significant role. In 2020, winds of change have both placed science among the trending topics and given strength to the international action of subnational players, like the State of São Paulo and FAPESP.

Through the lens of a visionary scientist and leader, who can see beyond horizons, Prof. Brito benefited from these contemporary characteristics the rising international scenario had to offer. Using the already internationally recognised pockets of excellence in science and innovation institutions throughout the State of Sao Paulo, Prof. Brito increased the role and importance of FAPESP worldwide, and aided the construction of a statewide reputation in the process. Grounded in the State of São Paulo's riches in income, population and existing quality of its scientific community, his political strategy was to make São Paulo's research collaborative and beyond borders, exhorting local researchers to interact with high-level external counterparts. The hypothesis behind his actions was that this strategy was likely to boost the scientific quality and impact of the research.

From theory to practice

To do so, Prof. Brito has encouraged bilateral and multilateral cooperation. As Scientific Director, he has promoted multiple partnerships both national, between researchers from São Paulo and other States of Brazil, and international, including the global South, with several research funding agencies and organisations, higher

education and research institutes, associations, companies and international organisations. As a result, he contributed to the scientific and technological advancement of the state of São Paulo.

FAPESP's international engagement includes being the only research funding institution from Brazil represented in multilateral fora such as the Belmont Forum, the Trans-Atlantic Platform and the Global Alliance for Chronic Diseases. Prof. Brito is the Chair of the Governing Board of the Global Research Council – an international organisation of national research funding agencies. In this regard, it is worth mentioning that in 2015 he was awarded an honorary Order of the British Empire (OBE) by the United Kingdom for his work in support of Brazil-UK science diplomacy.

One highlight of his tenure is also the insertion of FAPESP in international "Mega-Collaborations". Prof. Brito has encouraged, stimulated and personally followed up and created the conditions (both administratively and financially) for the participation of researchers from the State of São Paulo in many of the world's largest scientific efforts – Linear Collider Collaboration (LCC), A Large Ion Collider Experiment (ALICE), Deep Underground Neutrino Experiment (DUNE), Large Hadron Collider (LHC), Atacama Large Millimeter/ Submillimeter Array (ALMA), Giant Magellan Telescope (GMT), Laser Interferometer Gravitational-Wave Observatory (LIGO) and Cherenkov Telescope Array (CTA). Moreover, the technological and instrumental aspects of these consortia are encouraged through FAPESPs Innovation and Industry-related programs, being Prof. Brito himself a believer and enthusiast of the potential of such high-level technologies to local companies.

Sustainable development and research on climate change were also on his agenda. As a former invited reviewer of the Intergovernmental Panel on Climate Change (IPCC) Procedures, Prof. Brito has always been fully engaged in the environmental and social consequences of

global climate change. Two moments exemplify his embracing of the cause. First, in 2008, he created and launched a programme at FAPESP for advancing knowledge on Global Climate, called FAPESP Research Programme on Global Climate Change (RPGCC), which has financed dozens of projects, various workshops and fellowships. Second, the contribution to the Belmont Forum, an initiative that collectively funds research on the societal and environmental consequences of the climate change. FAPESP's contribution started when Prof. Brito was invited to participate in a meeting of the International Group of Funding Agencies (IGFA), an informal group of representatives from international agencies that support global change research, which later, in 2009, became known as the "Belmont Forum". Due to Prof. Brito's thrust, FAPESP has been taking part since the beginning in this initiative. FAPESP collaboration has been so important that, in 2019, it has been praised by the Belmont Forum Executive Committee as one of the five most participative and influential members, along with the US National Science Foundation (NSF), France's National Research Agency (ANR), the UK's Natural Environment Research Council (NERC), and the European Commission.

Making international collaborations work and grow requires a great deal of management efficiency, to let more human and funding resources directed to Science itself. That is why Prof. Brito has struggled to render FAPESP regulations and procedures leaner. Experience with the Horizon 2020, the European Commissions ERA-NET "Cofunds", the Joint Programming Initiatives (JPIs), as well as the Belmont Forum and others, has shown that, even though they congregate the best scientists worldwide, evaluation procedures and bureaucracies could be very overwhelming. Internally at FAPESP, Prof Brito has worked hard to soften that these hindrances, by adopting the trendy "Leading Agency" model in call for proposals. Under this model, proposal submission and evaluation procedures are centralized by one of the partner agencies for

effectiveness and resource savings.

When we look back and think of all these examples of international projection, we can see his touch at scientific diplomacy, which contributed to enlarge FAPESP's reputation and international reach. The outcome has been a win-win case scenario both for the State of São Paulo research community and for world's its partners worldwide.

Work Ethic

On a more personal note, from our perspective it is paramount to say that there are quite a few aspects to rejoice in when it comes to thinking of Prof. Brito as our leader. Three features strike us as the most precious lessons learned from him.

The first of them is his unflagging search for Excellence. He did not expect anything less than perfect for his requirements. He was able to drive very innovative new research and ideas, direct FAPESP's programs to new and strategic directions, presenting a keen eye for details and mistakes. In his work, he has always conveyed importance to work ethics in the tiniest of the details. He leads by example. His institutional presentations, for instance, were flawless and witty. Guided by excellence-oriented personality, he presented with impressive oral communication skills based on three main pillars: comprehensive knowledge of the subject at hand; preparedness to talk about it; and belief and critical opinion about the subject in question. No matter how big the audience would be nor whom was there, we could always see the solid and tangible passion and self-assurance that have driven Prof. Brito. Indisputably, this strong characteristic has helped us become better professionals to an unprecedented degree.

The second point relates to energy and determination. From our personal and professional experience, it is uncommon to meet anyone as committed, focused and with such fierce and vigorous drive towards

work as seen in Prof. Brito. He gives us the impression of someone who works 24/7, but who also finds time not only to read about science, innovation and science policies, but also to run and lead a healthy, fit life. His dedication is both contagious and impressive. It was not unusual to leave a document on his desk requesting his approval for something on a Friday evening (after he had left), and finding his reply on our desks on Monday morning (before he arrived). That means: weekends were also workdays!

Our third note relates to ethics and respect. He treated all areas of science equally, wisely ignoring the silos so common in academia. The progress of science would be his guiding compass, regardless of knowledge area. His respect for the mission of FAPESP in every decision-making was always extremely clear and gave us direction and a sense of pride in our work. To work for the public service is, therefore, to work for the benefit of society, both directly by affecting scientists, and indirectly through the impact produced by FAPESP-funded science. Prof. Brito always kept us aware of that, and reminded us that we were contributing for a large and important goal.

These three aspects made us understand in a unique way how steadfast in our commitment towards life we should be, helping us become much better professionals and citizens. After all, we live in an interdependent world, struggling with similar and interconnected challenges. Global challenges knows no state boundaries, and neither does science. The Greek philosopher Socrates statement that "I only know that I know nothing" looks at human being's individuality. But, collectively, together, we learn more, we know more and better. As the poet John Donne said in one of his most renowned poems, "No man is an island entire of itself; every man is a piece of the continent, a part of the main". Just like art, we learned from Prof. Brito that science makes business more competitive, heals the sick, makes the poor rich and makes humankind wiser.

Scientific Directorate – Team
Proposals & Follow up Management Team

A NEW PARADIGM OF ADMINISTRATIVE EFFICIENCY

Luis Fernando Artoni Junior, Marina Marmontel Leite do Canto, Thais de Souza Costa Molari – on behalf of the Proposals & Follow up Management Team

Writing the conclusion of a scientific endeavour is one of the greatest challenges in the entire project. It is when researchers reflect on the meaning and results of their investigation and translate them into scientific contribution, casting light on their research inquiries and curiosities. New syntheses can pave the way to new scientific questions, innovation and, eventually, the improvement of humankind's well-being. Conclusions represent the farewell of one scientific journey that can kindly assist and foster the beginning of many others.

Professor Carlos Henrique de Brito Cruz tenure as Scientific Director of the São Paulo Research Foundation (FAPESP) has reached its closing chapter. And we, collaborators of the Scientific Processes Management Team, have been offered the opportunity to pay tribute to his work and legacy, which will linger on the institution memory, both in its local and international expressions.

We believe that Professor Brito has led the organization to a higher new institutional level. It is true that he has been a respectful and admired leader when it comes to Brazilian regional research funding agencies. But he has also acted as a strong representative abroad of the science locally produced in the State of São Paulo, by crossing oceans and international borders.

To achieve this purpose, throughout his 15-year tenure he stimulated the community to publish more and in better journals, especially those with a large global readership. Another strategy was the creation of Research Fellowships Abroad (RFAs), to promote exchanges with universities and major research centers in other countries. This innovation enabled many students of higher education institutions from the State of São Paulo to make their first contact with international science. It was equally crucial to give researchers an opportunity to find out more about the research done in other countries, engaging in significant partnerships and making the science produced in the State of São Paulo better known and more competitive.

Consequently, the innovation promoted by Prof. Brito's strategic vision enabled the creation of agreements and partnerships with the world's leading universities and research institutions. The impact of this policy was unprecedented, thanks to Prof. Brito's visionary and entrepreneurial spirit. Researchers can certainly bear witness to it.

Excellence and innovation

One of Prof. Brito's most innovative actions, right at the start of his tenure, was his effort as Scientific Director and leader to restructure the Scientific Directorate towards modernization. His actions raised the efficiency of internal processes, minimized response times, enhanced the quality of communication between FAPESP and the scientific community, improved results and optimized resource use.

At that time, he created specific thematic units – internally called "cells" – made up of teams charged with managing processes and procedures in each of the four big knowledge areas, encompassing all activities throughout the duration of each project up to the publication of results.

This initiative greatly increased the staff's engagement and commitment to their work and those of the Scientific Directorate with the other sectors of FAPESP.

Next, Prof. Brito created a group of four Scientific Project Coordinators, made up of highly active professionals, who also represented the major knowledge areas, to manage and facilitate the work of external reviewers as well as the Area and Adjunct Panels, which are our internal assessment instances. The analysis and peer review processes accelerated and achieved excellence as a result.

Another contribution worth mentioning was Prof. Brito's idea to organize monthly sessions of proposal analysis to optimize resource use. In so doing, applications for Thematic Project Grants, Young Investigator Awards and Regular Grants with large budgets or requiring amounts of funding above a set limit could be assessed in a special meeting, exclusively designed to concentrate the attention of all internal panels in a joint meeting.

Regarding scholarships, Prof. Brito strived to ensure that as many applications as possible could be included in the budget of research projects already financed by FAPESP, from undergraduates to postdoctoral fellows. He also created a system of quotas for grants as items in research project budgets. Furthermore, as far as individual scholarships were concerned, Prof. Brito promoted them by ensuring assessment based on excellence according to competition, transparent and predetermined criteria, and collegiate assessment in monthly sessions.

Always adopting a didactic approach to clarify the rules and procedures that support all these changes, our leader oversaw the drafting of Normative Instructions, fostered their use by the Area and Adjunct Panels and ensured compliance by the staff, who aligned with the new proposed criteria.

Operationalization of procedures

In his administration, Prof. Brito has steadily pursued ideals of excellence and efficiency, implementing mechanisms of process management, control and visibility such as:

- Upgrades to and adaptations of SAGe, FAPESP's online project management platform, to optimize peer review response time, resource use and efficiency; and the creation of processing flows based on the needs and characteristics of each funding line or instrument;
- An information base on the members of Area and Adjunct Panels in the Agilis system, promoting transparency regarding the instances of analysis and their members;
- Organization of the Scientific Directorate to facilitate the use of FAPESP's financial systems and access to information on payments to projects;
- Regular meetings of managers with technical staff to present changes, to propose improvements and to discuss ways of refining and integrating internal processes and systems, especially SAGe.

It would be difficult to remember every detail and contribution of the 15 years during which Professor Brito has been Scientific Director of FAPESP, but there can be no doubt that, in total, they represent a paradigm shift in the efficiency of the work done by each of us, individually, and by FAPESP, as a whole. At the same time, his innovative spirit of leadership and unremitting pursuit of excellence at all levels have unquestionably given us all a sense of importance and professional satisfaction with which we were unfamiliar until he came on board.

In this spirit, we offer thanks on behalf of staff, co-workers and admirers for the opportunity we have had to share and contribute to his vision and enthusiasm for the work that has motivated and fired us all.

Good work, professor!

Scientific Directorate – Team Assistants

A BIT OF BACKSTAGE

Fernanda Biondi, Isnard Magnus

We have worked close to Prof. Brito from the beginning of his tenure as his direct assistants. We are part of backstage of his work. For us, having had this opportunity represented a period of great learning. He is an extremely intelligent person, dedicated and very focused on contributing to the development of Science and Technology in the State of São Paulo. In our opinion, he symbolizes a great example of determination and willpower. Since 2005, we have witnessed his dedication, his moments of joy and anger, as well as the strong commitment with which he commanded the Scientific Directorate.

From the beginning, what caught our attention was the perception of his genius mind. We are not talking about his academic curriculum, which is undoubtedly impeccable, nor about his incredible knowledge on various subjects. We are referring to his way of thinking. It really gives pleasure to work with someone who can always finds innovative and different solutions and whose brilliant intellect we admire.

In the past 15 years, we have not seen Prof. Brito rest for long periods. After all, neither vacation nor holidays have prevented him from working hard. It has been very common to see him "up and running" any time of the day or night, even on weekends. It is amazing how he manages to make himself present, even when he is in external commitments.

Prof Brito's schedule has always been very complex and busy, to which he attended with great energy. Trips, meetings, videoconferences ... It was routine to see him leave one appointment and move on to the next without any pause. Without any rest. He took advantage of every minute to dispatch, discuss matters with his advisers and coordinators, resolve matters by telephone or return calls. It is curious to note that, in the busiest days, we wouldn't even remember to have lunch! To help him go through, we would buy him snacks and beverages of his liking and remind him that he needed to eat something.

He has also always been very reserved, probably because of his shyness, or partly because of his busy schedule or the responsibility of having to make difficult decisions. Despite this, he would always be attentive to the difficulties of those close to him. This fact has never been of public knowledge, but it is true that he kept himself informed of the problems of others and made himself available to help them as much as he could.

We can only be grateful for the challenges launched, for the professional growth and for the learning we had with him. We wish Prof. Brito a great next journey, where can show his caring heart, his strength and the sparkle in his eyes in search for more professional and personal accomplishments.

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A VIRTUAL LIBRARY TO SUPPORT THE REAL PRODUCTION OF KNOWLEDGE

Rosaly F. Krzyzanowski

Among the São Paulo Research Foundation (FAPESP) channels for the dissemination of institutional actions on scientific, technological and innovation development, there is a referential information source known as Virtual Library (BV) – Research Supported by FAPESP on the website. This has achieved remarkable progress in order to contribute to fulfilling its goal of recording and disseminating referential information on FAPESP's research scholarships and grants.

BV is considered an open-access referential database model, with public interfaces in Portuguese and English. In addition, the "Retrospective database of FAPESP funded-research projects, 1962-1991" aims at providing access to granted research referential information and is available to users via the BV homepage. BV's vision statement is to establish a virtual library model for the state research foundations in Brazil, aiming at generating products and services for the scientific community according to international rules and standards of information processing and data communication.

The idea of establishing a virtual library occurred in the 2000s, more precisely in 2003, based on the proposal to create in Brazil a National Policy for Science and Technology Memory Preservation that would enhance the visibility of Brazil's institutional scientific production. In

2005, FAPESP launched its Documentation and Information Center and Virtual Library "which gathers information about science, technology and innovation in a unique platform on the Internet" (*FAPESP 2005 Annual Report, p. 127*).

The first stage was the development and implementation of the FAPESP Virtual Library project, with the adoption of available technology. Next, it was necessary to key in the data concerning the scientific articles and academic literature arisen from supported research, as informed by grantee researchers. However, since 2010, in compliance with the recommendations of the Computer and Information Technology Coordination in FAPESP's Scientific Directorate (DC/FAPESP) under Prof. Brito Cruz's guidance, monitoring and vision, the former technological procedures and resources have been renewed to improve the virtual library and adapt it to the institution's needs. This restructuring, as well as further directions to the BV technical team, resulted from Prof. Brito's encouragement and attention to drive the project toward greater visibility for users and to reinforce BV database consistency. It also enabled the revitalization and modernization of adopted procedures and resources, emphasizing the automated recording of information as well as greater interactivity with FAPESP's internal databases (Agilis, SAGe, CPD and Communication area channels). In the following years, a series of implementations have been carried out aimed at improving the automated recording and retrieval of information through the available mechanisms as well as providing access to BV content through the Foundation's website and Internet search engines.

As soon as FAPESP's new programs, research lines, and scientific and technological cooperation agreements have been created and/or signed, Prof. Brito with his usual expertise and enthusiasm pointed out the importance of creating the respective pages at BV. Then, graphs and geographic distribution maps were also provided, thus expanding

the visualization of granted research reference information in these contexts for users.

For this purpose, BV's technical team has developed a detailed work of implementing technological functionalities and organized and standardized the information according to international standards, in order to improve the possibilities of information retrieval in these databases. In searches carried out by users, several search refinement options are available for achieving greater precision in results.

In BV contents, themes are mainly identified as basic research, applied research and innovation, as well as those that offer a focus on research internships for early career researchers and qualification of companies headquartered in the State of São Paulo, for cooperative research and development.

Thus, some value-added information has been added to BV to increase the visibility of supported research through graphics resources and modules such as:

- **FAPESP Researchers (Principal Investigators and/or Grantees of FAPESP support)** – This page contains links to researcher's academic résumés on the national database (CV Lattes) and international web-based query databases (ResearcherID, GoogleMyCitations, ORCID). It also provides access to other important information about researchers.
- **Maps and graphs** on the geographic distribution of research grants in the State of São Paulo, as a contribution to rapid identification of regions and institutions that have participated in each research funding line. The graphs display data on FAPESP's support for current and completed research projects over time.
- **Media highlights** – Coverage of projects by Brazilian and foreign media, both specialized in science and of general interest.

- **Recent highlights** – A page containing a slideshow selection of newly approved projects.
- **International collaboration** – A page with information on international collaborative research funded by FAPESP.
- **References of scientific articles resulting from FAPESP support to research** (retrieved automatically from Web of Science and SciELO journal databases). FAPESP support and grant number are included in the texts by their authors.
- **Research themes** – A page with information on grants awarded by FAPESP for research on strategic themes and issues of interest in science and society.
- **Home-research Institutions** – A page with information on research grants and their respective home institutions, such as universities, research centers, higher education institutions/non-universities, professional associations, hospitals, archives, museums and information centers, schools of the Public Education Research Program etc.
- **Higher education and research institutions abroad** – FAPESP encourages granted researchers to develop collaborative research with renowned partner organizations from other countries. These can be universities, research institutions, higher education institutions/non-universities, hospitals, museums, archives and information centers.
- **Intellectual property** – FAPESP intellectual property database at BV displays records of patents and computer programs supported by FAPESP for their design and protection. The database contains information on intellectual property resulting from research projects funded by FAPESP or the protection obtained through the Support for Intellectual Property Program. Only records on intellectual property already published are available for consultation.

- **Subjects** – Records of FAPESP's funded research projects by subject area and suggestions of related subjects for new searches of BV databases.
- **FAPESP Classification schemes** – A hierarchical list used by researchers for submission of project proposals and information retrieval.

BV enables the exchange of reference information on research funded by FAPESP with other academic information systems in the State of São Paulo based on cooperation agreements including the University of São Paulo (USP), University of Campinas (UNICAMP), São Paulo State University (UNESP), the Nuclear and Energy Research Institute (IPEN), and the Brazilian Center for Research in Energy and Materials (CNPEM). Through this exchange, referential information on dissertations and theses resulting from FAPESP's support is incorporated into the pages of the Virtual Library, with links to the full texts when available from the digital libraries of the institutions concerned. BV also sends referential information records periodically from FAPESP on Alzheimer's disease and related dementias to the International Alzheimer's and Related Dementias Research Portfolio (IADRP) database, maintained by the NIH National Institute on Aging and the NIH Library in the United States.

It is worth mentioning that in 2009 data on the BV website's users showed 860,000 annual visits. The number has since grown significantly and the average number of annual visits is now about 4 million. Such results certainly meet the interests of the academic community and society in general to access information on scientific knowledge and innovation. The ever-present support of Prof. Brito Cruz for BV's evolution, together with the Virtual Library team's engagement, has helped to drive the exponential growth of this database for the dissemination of information on research funded by FAPESP.

The Virtual Library disseminates its content and services. In addition

to Internet search engines, with optimization through the application of SEO (Search Engine Optimization) techniques, its participation in the social network Twitter and in specialized events, with presentation of communications, posters, lectures and articles in library and information science journals are also considered.

Comunicating Science to the Public
Special Program in ST&I Indicators

BRITO CRUZ AND THE DEVELOPMENT OF SCIENCE, TECHNOLOGY AND INNOVATION INDICATORS AT FAPESP

Renato H. L. Pedrosa[1]

'The errors which arise from the absence of facts are far more numerous and more durable than those which result from unsound reasoning respecting true data.' Charles Babbage (1791-1871)

The above quote opens the preface that Brito Cruz, then president of the Superior Council of FAPESP, wrote for the first comprehensive publication about ST&I indicators published by the foundation, back in 1998. It was a relatively short 142-page volume, titled *Indicadores de Ciência e Tecnologia em São Paulo*[2], and included data and information about ST&I activities developed by institutions and organizations located in the state of São Paulo. It was, to the author's knowledge, the first comprehensive collection of facts and figures about S&T published in Brazil. In that preface, Brito Cruz wrote that FAPESP intended, with its publication,

> *"to contribute to the objectivity of the debate on and the planning of S&T in the State (of São Paulo). Scientists like and need to know the facts and data in order to learn and to develop forecasts, but the planning of S&T in Brazil has suffered from a lack of reliable indicators."*

1 Science and Technology Indicators in São Paulo. Coord. Francisco Romeu Landi, FAPESP, São Paulo, Brasil, 1998.

2 Charles Babbage (1835). On the Economy of Machinery and Manufactures, 4th Ed. Charles Knight, London, UK.

So, the link to Babbage's quote is clear: very rarely it is possible to devise a sound analysis which allows for reliable forecasts of many human society's aspects without true data and, as Brito points out, reliable indicators. Babbage's quote comes from the chapter entitled *Of Price as Measured by Money* in his book *On the Economy of Machinery and Manufactures*, closing a section in which he discusses the precision of data from a table he presents to show the reduction of prices of various industrial products in Birmingham, collected between 1818 and 1830. Just before that quote, Babbage acknowledges that, with respect to the table he presented and used,

> *"if a small committee were to undertake the task (of collecting data for more goods and from different areas), it would give great additional weight to the information." (Babbage 1835, pp. 155-156)*

That is the perennial challenge posed by any method of collecting data about most areas of human activity: it is always possible to think of better ways to do it than what is available at hand. But some (true) data is better than no data, and even poorly argued analysis from true data tends to be closer to truth than any argument based on opinion only, as Babbage puts in more elegant phrasing. Babbage's book was one of the first detailed studies about the economic impact of technology. If written today, it would certainly make use of the ST&I indicators produced by such organizations as the Organization for Economic and Cooperation Development (OECD), the U.S. National Science Foundation (NSF) and, why not, if Brazil and São Paulo were part of the analysis, by FAPESP. Using the information at his disposal, Babbage comments on the effects of technology on industrial productivity resulting in the continuous decline of prices observed for all sorts of manufactured products. For example, on the reason of the decline of the price of brass knobs used in doors, Babbage sees the impact of technology on new manufacturing methods:

> *"One circumstance which has produced this economy in the manufacture*

> *is, that the lathe on which these knobs are finished is now turned by a steam-engine; so that the workman, relieved from that labour, can make them twenty times as fast as he did formerly." (Babbage 1835, p. 159)*

Of course, since Babbage's times, recognition of how technology has impacted all areas of human society, from personal affairs to economic development to geopolitical strategic thinking and practices, is common knowledge. As are the impacts of technological industrialization on the environment, as climate change, the contamination of rivers and oceans, urban pollution and its other consequences show in such dramatic fashion. At the same time, science is constantly trying to understand how human action affects both society and the world, by advancing knowledge that is used to develop new technological responses to the challenges that technology itself, in many cases, helped create. And, for that, data collection, the development of all types of indicators and the analysis and forecasts they make possible are essential tools for contemporary society to develop policies to overcome those challenges.

Today, as the digital age is finally showing the full impact of its consequences on human society, including personal and social life, employment and urban planning, health-related applications and energy production and distribution, among others, it is more important than ever to have sound data on the results of ST&I activities, for exactly the reasons Brito Cruz mentioned in the quote from the preface of that first attempt by Fapesp to produce ST&I indicators for São Paulo (and, *a fortiori*, for Brazil).

Going back to FAPESP's own ST&I indicators development program, Brito Cruz was certainly aware of the difficulties involved in that first effort, back in 1998, especially with respect to collecting data used related to ST&I activities (estimating expenditures in R&D by businesses comes immediately to mind for anyone who has tried to go below the surface in such matters). The effort to collect enough data and to develop reliable and valid indicators is never-ending, both from

the practical aspects related to actual data collection to methodological ones, which are, themselves, subject to scientific research. He concludes his brief text by stating FAPESP's intention of keeping with the initiative of collecting and publishing such information,

> *"… constantly providing São Paulo's S&T institutions, as well as legislators and planners, with indicators that allow them to improve constantly the effectiveness of the State's S&T system."*

And indeed, FAPESP's efforts to produce and publish ST&I indicators continue to this day, and Brito has been part of that effort all along the way. They have included, along with the 1998 volume, other three books, in 2001, 2004, and 2010, then there have been a series of smaller publications, the introduction of a monthly page in *Pesquisa FAPESP*[3] magazine entitled *Dados* and a section in FAPESP's annual reports on São Paulo's ST&I system, with updates on relevant data and information pertaining to all major aspects of ST&I activities in the state, including national and international contexts. In many cases, they included deeper analytical results, showing how different indicators relate to each other, using standard statistical methodologies. During all those years, Brito Cruz was always more than an interested partner of the enterprise, as he actively participated in many of the developments, as we will describe next, after we list in more detail the areas which have been treated by FAPESP's ST&I Indicators Program, namely:

- *basic and higher education (enrollment, degrees, etc.)* developed by schools and higher education institutions, including undergraduate and graduate degree-granting programs;
- *expenditures in research and development* funded by organizations

3 *Pesquisa Fapesp* magazine is a monthly magazine and reports on the results of FAPESP funded projects. It also publishes analytical articles of various ST&I topics and has some special sections, one of which is "Dados", dedicated to ST&I indicators. They may be about FAPESP's own projects, but are mostly general ones, related to São Paulo, Brazil and, in some cases, to international aspects of ST&I. See more about it in page 176.

beyond FAPESP, including federal agencies, and performed by universities, research institutes and businesses;

- *human resources in ST&I (researchers)* employed in the state by all types of organizations;
- *scientific output (journal articles and other forms of documents)* authored and coauthored by scientists working for organizations in the state, indexed by international organizations, like Web of Science and Scopus;
- *innovation output (patents and other intellectual property items)* developed by organizations of the state.

Brito Cruz has been involved directly in all these areas of the program, but especially in estimating expenditures in R&D, in collecting data on people employed in research activities and in using bibliometric indicators related to scientific publications.

Regarding the estimation of expenditures in R&D by private businesses, Brito Cruz developed a very interesting methodology to estimate them using regression methods relating expenditures to the gross fixed capital formation, the usual measure of investments by the economy used in national account systems that estimate a country's GDP. The method is described in detail in the appendix to Chapter 3 of the FAPESP's 2010 ST&I Indicators in São Paulo and has been developed further in recent years. It is still in use, providing very good estimates for the years between surveys from PINTEC, the national innovation survey developed by the Brazilian Institute of Geography and Statistics (IBGE), which is done every three years. Brito has also been active in collecting and estimating expenditure data from public organizations like the National Scientific Council (CNPq), the Coordination for the Advancement of Academic Personnel (CAPES) and the Projects Financing Agency (FINEP), all federal funding agencies, from universities and from research institutes located in São Paulo. Along the way, he also collected information regarding researchers active in those organizations.

With that, FAPESP has developed a very complete pictures of the sources of R&D funding performed in the state, which has been published yearly in the pages of the Magazine and of the annual report. More recently, he has supported the development of surveys to also collect data about where the expenditures actually happen, completing a matrix of source-performance for R&D expenditures in the state, the first such effort in Brazil. This survey is being developed by a group of specialists in working in cooperation with the recently organized *Studies and Indicators Management Unit (GEI[4])*, under the Presidency Director's office at FAPESP (more about the Unit below).

Regarding bibliometric indicators of scientific publications, Brito has always followed the evolution of the literature and used the available international databases, like Web of Science and Scopus. In particular, FAPESP, through his action, has been very active in providing feedback to the Web of Science/Incites system currently run by Clarivate about Brazilian and São Paulo institutional identification, a not so simple task as organizations tend to be identified in dozens of different ways by their own researchers as they include their professional addresses in their papers and other documents. FAPESP's own ST&I indicators include bibliometric info that are available directly from Incites/Clarivate, but has also developed quite a few new ones, or prepared studies using raw Web of Science data. Recently, Brito Cruz studied the relationship between academic and industry scientific literature, by developing an in-depth study showing how Brazilian universities, not only those in São Paulo, collaborate with industry via co-authorship of scientific papers and other publications. This study has been published internationally[5] and has also have impact in the debate in Brazil, as it contradicts the common-sense

4 Gerência de Estudos e Indicadores (GEI), Diretoria da Presidência, Conselho Técnico-Administrativo (CTA), FAPESP.

5 Brito Cruz, C. H. (2019). Benchmarking university/industry collaboration in Brazil. In: Reynolds, E.B, Schneider, B.R, Zylberberg (eds.), Innovation in Brazil – Advancing Development in the 21st Century. Routledge, London, 2019, pp. 120-143.

opinion that Brazilian universities do not show much interaction with industry. In fact, his study has shown that the level of collaboration between Brazilian universities and industry has not only grown rapidly in the last few decades but is now at a level not too different from those for U.S. universities. Another example, not directly developed by Brito Cruz, but by the Scientific Directorate's Coordination of ST&I Indicators, is a study about scientific collaboration between states in Brazil, which has shown that it has increased significantly over time and always helps publications' rate of citations by other publications, at the international level, a typical parameter of the scientific impact of research.

One other area that FAPESP was involved regarding ST&I indicators in the last couple of decades was the collaboration with the Ministry of Science, Technology, Innovation and Communication's ST&I indicators program. The Ministry started publishing data about expenditures in R&D during the 1990s and had its program revamped in the early 2000s, with a careful revision of the methodologies employed. It included estimating expenditures by the states, and the process, at least until 2015, involved strong collaboration between the Ministry's indicators program and the states' organizations which would help collect data and validate those estimates. FAPESP was São Paulo's organization responsible for that activity, as it had already started developing the same estimates for the states since that first volume from 1998, and Brito Cruz and his collaborators in the Coordination of the Special Program in ST&I Indicators were directly involved in those efforts. São Paulo's contribution would always be considered the state-of-the-art initiative in ST&I indicators among the federation members and helped the Ministry's people develop the methods to better estimate states' expenditures in R&D. The Ministry's program has suffered some discontinuities and the participation of the states in the development of estimates for their expenditures ceased in 2015 and has not been renewed since then.

Starting in 2017, FAPESP has developed further its role regarding

ST&I indicators. Under the Presidency Directorate, the already mentioned *Studies and Indicators Management Unit* was established at the end of that year with the mission of institutionalizing many aspects of FAPESP's indicators program. In particular, the main thrust behind the new unit was that it would concentrate development of the program that were considered more routine. At the same time, a new regular research project would be responsible for developing new indicators and deeper analytical studies on various themes related to ST&I activities. The new unit has grown, by the end of 2019, to involve a group of four permanent people and one more experienced person who came from the Seade Foundation, the statistics agency of the state government. As 2020 begins, the new unit is about to launch the new homepage of ST&I indicators, which will include historical series for many of the indicators FAPESP has developed along the years (see above for the main themes that have been subject of FAPESP's program). The page will also have links to all previous publications, including the ST&I Indicators volumes and the *Pesquisa FAPESP* magazine, in *Dados* pages, along with various other publications and current news about ST&I. It should be online by the time this volume is in print. The research project on ST&I indicators has also been renewed for another two years and will continue to develop studies on special topics and indicators of ST&I. One such study, already under development, is about the education and employment of engineers in Brazil, an important segment of professionals involved in the development and use of new technologies. Other professional and research areas of interest to ST&I will be also studied in the next two years.

We conclude this brief note on Brito Cruz's role in the development of ST&I indicators at FAPESP by observing that FAPESP, the state of São Paulo, all its academic, scientific and other institutions, including government ones, should be proud of having had him dedicate himself with total focus and energy to that very important activity. We are confident that his interest in ST&I indicators will likely not end with him

leaving the Scientific Director post, as it is clear, from his actions and writings, that it is one of his passions, and Brito is enormously passionate and forceful when he takes interest upon some topic. All those that have worked with him on this subject will always remember how careful, how dedicated to truth and validity about data collected and their uses, he has always been, and how important he thought ST&I indicators are in regard to their use in the development of good public policy practices, as he clearly states in that preface to the first volume of FAPESP's ST&I indicator, back in 1998.

Comunicating Science to the Public
***Pesquisa FAPESP* Magazine**

HELPING TO BUILD A SCIENTIFIC CULTURE IN BRAZIL

Alexandra Ozorio de Almeida, Luiz Henrique Lopes dos Santos, Neldson Marcolin

Pesquisa FAPESP is one of the few publications in the Brazilian press dedicated to reporting scientific and technological research carried out in the country. With institutional and financial support from the São Paulo Research Foundation (FAPESP), *Pesquisa FAPESP* has become a reference in science journalism. The publication features rigorously prepared news articles based on research outcomes that contribute to the national debate on science, innovation and science policy.

Created in 1995 as a news bulletin, *Pesquisa FAPESP* became a magazine in 1999, at a time when the Foundation was focusing on institutional and scientific communication. The Foundation's newly established communications department housed the magazine, which gradually developed its own characteristics and role, becoming independent of the department's institutionally focused activities.

FAPESP's statute, implemented by means of Decree n. 40.132 of 23 May 1962, establishes the Foundation's mission as supporting scientific research projects in the State of São Paulo, to which end the Foundation must promote or fund the publication of research findings, as established in article 1, VIII. This guideline provides the basis for the activities of *Pesquisa FAPESP*, which has as its aim the promotion

of scientific culture in Brazil and the dissemination, through various communication channels, of the outcomes of scientific research carried out in Brazil, with emphasis on research carried out in the State of São Paulo with FAPESP funding.

In the course of its 20 years of existence, *Pesquisa FAPESP* has become a producer of journalistic content, published in various outlets. Its flagship is still the printed version of *Pesquisa FAPESP* magazine, published monthly in Portuguese. In October 2019, the magazine had 5,100 subscribers and sold 1,000 copies a month in newsstands and bookstores. It is also distributed free of charge to 28,400 FAPESP-funded researchers and fellowship beneficiaries, as well as *ad hoc* peer reviewers that assist the Foundation. All the content published in the magazine is available at the *Pesquisa FAPESP* website, and the content is open to republishing through a Creative Commons licence. The website has content produced exclusively for digital media, such as news features and photo galleries, as well as versions of the magazine's articles translated into English and Spanish. The website, which attracts approximately 405,000 visits per month, hosts the podcasts derived from the weekly radio program broadcast by the magazine's newsroom staff in partnership with the University of São Paulo. It also hosts the fortnightly videos which, like the radio programme, are based on articles published in *Pesquisa FAPESP*.

Pesquisa FAPESP uses the main social media platforms to publicize its content. Facebook is the main channel (182,000 fans), followed by Twitter (82,000 followers), and with growing participation on YouTube and Instagram. International print editions of the magazine are also published regularly, with three editions a year in English, two in Spanish and one in French, all carrying a selection of the features produced for the Portuguese edition. Besides a selected mailing list, these editions are mainly distributed in international events promoted by FAPESP.

Notícias FAPESP news bulletin became *Pesquisa FAPESP* magazine

during Carlos Henrique de Brito Cruz's tenure as President of FAPESP (1996-2002), and he has always followed the project closely. His participation initially focused on the institutional management of the magazine. When taking up the post of Scientific Director in 2005, the magazine entered Brito's remit, as a project associated to that Directorate, and his involvement became more direct. He proposed, for example, that the magazine be distributed not only to researchers with FAPESP grants, but also to FAPESP fellowship holders. With the establishment of the FAPESP Code of Good Scientific Practice in 2011, Brito suggested the creation of a section in the magazine dedicated to issues related to scientific integrity. Due to significant reader interest, in 2016 the Good Practices section was extended from one to three pages and continues to attract much attention, being used for educational purposes by lecturers and teachers.

Brito's activities in the science and technology policy area, with emphasis on S&T indicators and metrics, led to the proposition of a section called Data, published in *Pesquisa FAPESP* since 2012 under his direct supervision. Brito's attention to the section frequently leads to several additions and improvements, making it one of the last pages of the edition to be closed.

Watchful of growing digital audiences, Brito established that all news articles published in the magazine should be available in PDF format, to facilitate sharing. He made a case for highlighting features on innovation, connected to FAPESP's Research for Innovation in Small Businesses (RISB) and Research Partnership for Technological Innovation (PITE) programmes, as well as articles on activities developed by researchers working in the private sector.

Brito has referred to the newsroom many suggestions for features, forwarding materials collected on visits and meetings in Brazil and abroad, as well as reads, and helping to build many important news articles. Examples are the cover articles on the detailed composition of

federal spending on S&T (June 2017) and Education (March 2019), in a national context of budget cuts and freezes.

With his support, *Pesquisa FAPESP* has become a consolidated reference in science journalism, a long-term project that demonstrates its relevance on a daily basis. The activities of *Pesquisa FAPESP* are relevant in a broader context, helping to build a scientific culture in Brazil, and more specifically, through its support of the Foundation and its work.

Comunicating Science to the Public
Communication Department

THE GROWTH OF SCIENTIFIC COMMUNICATION IN FAPESP'S AGENDA

Claudia Izique, Heitor Shimizu

Research projects supported by FAPESP had more than 33,000 mentions in Brazilian and international media in 2019. In 2005 the number of citations was slightly more than 1,400.

The advance of FAPESP's media exposure is the result of several factors, including more aggressive communication strategies, the refinement of information technology in the period, and increased attention to science and technology on the part of many citizens.

However, it must also be credited to the central role played by the scientific knowledge diffusion in the agenda of Carlos Henrique de Brito Cruz, FAPESP's Scientific Director since 2005, which grew in importance until it was included in 2018 – with the approval of FAPESP's Board of Trustees–in the Foundation's research funding strategies, alongside Training of Human Resource for Research, Basic and Applied Research, Research for Innovation, Strategic Research and Research Infrastructure.

The process began in 1997 with the creation of the *Newsletter FAPESP*, which gave rise to *Pesquisa FAPESP* magazine, gaining momentum in 2002 with the creation of a unit dedicated to institutional communication – the Foundation's Communication Department.

In the second year of Brito Cruz's term, FAPESP's internet Portal, created in 2003 with Portuguese- and English-language versions, was

reformulated to facilitate access to information on the scholarships, grants and programs offered by the institution, and also to increase the news coverage about the results of research projects supported by the Foundation. This initiative contributed to a rise in the number of visits to the Portal from 178,000 in 2006 to 2.7 million in 2011, when the site was reorganized to target FAPESP's various stakeholder groups, such as grantees, researchers and reviewers, as well as journalists.

Another restructuring, carried out in 2013, highlighted the *News and Research* section on the Portal's home page alongside *Funding Opportunities*, *Research Geared Towards Applications* and *About FAPESP*. At the request of FAPESP's executive board, the 2020 version of the Portal is under development to be launched by mid-year. In this new version, the science diffusion remains proeminent in "windows" devoted to stories and reporting in *Pesquisa FAPESP*, *Agência FAPESP* and the newsletter *Pesquisa para Inovação* (Innovative R&D), as well as videos and a web TV feature, among others.

The aim of these changes is to facilitate and customize access to a growing number of pages and sites that have gradually been added at the direction of Brito Cruz, such as the sections on Funding Opportunities, Engineering Research Centers (ERCs), Research, Innovation and Dissemination Centers (RIDCs), the São Paulo School of Advanced Science (SPSAS), and Indicators (under construction), to take only some examples.

The growth of *Agência FAPESP*

Brito Cruz closely follows each daily edition of *Agência FAPESP*, as both a critical reader and assignment editor. The *Agency* was created in 2003 to produce information on research results, calls for proposals, funding opportunities and other news about FAPESP. Its subscriber base has grown from 50,000 in 2005 to 144,000 in January 2020. The number of visits to the Agency's website has soared to 3.7 million per

year, from a mere 2,000 per year in 2005.

The rigorous accuracy of its reporting and its agility in disseminating information have strengthened *Agência FAPESP*'s reputation as a benchmark for the production of content on science, technology and innovation. The articles it publishes are replicated or followed up in new assignments by the State of São Paulo and national media, and English-language translations are reproduced by media outlets in many other countries. On the other hand, the reputation won by *Agência FAPESP* among researchers for efficiency in publicizing their work has resulted in a growing supply of good stories with which to enrich each weekly newsletter. A productive dialogue with the general readership and with researchers helps promote the production and dissemination of knowledge.

The challenge of international diffusion

Expanding the international journalistic diffusion of projects supported by FAPESP was one of the most important challenges Brito Cruz presented to the Communication team. The English-language version of *Agência FAPESP*'s weekly newsletter was created in 2011. In the same year the first of 18 editions of FAPESP Week was held to stimulate research collaboration.

Editions of FAPESP Week have now been held in the United States (2011, 2012, 2013, 2014, 2016, 2017 and 2018), Canada (2012), Spain (2012 and 2015), the United Kingdom (2013 and 2019), Japan (2013), Germany (2014), China (2014), Argentina (2015), Uruguay (2016), Belgium (2018) and France (2019). News about those meetings were published in the Portuguese and English editions of *Agência FAPESP*.

Editions of FAPESP Week, as well as *Agência FAPESP*'s newsletters in English and Spanish (launched in 2014), reinforced the Foundation's international visibility. In the intervals between those meetings, the two versions of the newsletter mainly feature stories on the collaborative

projects conducted by researchers affiliated with institutions in the State od São Paulo and abroad. There is no lack of information: between 2005 and 2019, the number of cooperation agreements signed by FAPESP jumped from two, with France and Germany, to 310 with 37 countries, multiplying the number of collaborative research projects.

The most significant advance in FAPESP's international exposure occurred in 2017, when *Agência FAPESP* began posting news articles to international science diffusion platforms such as EurekAlert and the Ibero-American Agency for the Diffusion of Science and Technology (DiCYT). International media mentions of FAPESP have risen exponentially, from 312 in 2016 to 5,304 in 2019.

Brito Cruz, as well as FAPESP's other directors and managers, can keep track of this evolution in the daily clippings distributed internally by the Communication Department and also by *FAPESP na Mídia*, an open-access website that catalogues and monitors mentions of projects supported by the Foundation in domestic and foreign media. At end-2019, its database contained more than 150,000 news items.

When the statistics showed that the number of foreign media mentions of FAPESP had doubled, Brito Cruz presented a new challenge: linking the stories about research published in the media at home and abroad to the pages for the projects concerned hosted by the Foundation's Virtual Library (*Biblioteca Virtual*, BV). The response to this challenge added to Communication's mission the job of providing services to researchers and enhanced its science diffusion capabilities by significantly increasing the flow of news-ready information to *Agência FAPESP* from the scientific community.

Support for technological innovation

FAPESP runs two technological innovation promotion programs: Research Partnership for Technological Innovation (PITE), which

focuses on collaboration between universities and companies and was launched in 1996; and Innovative Research in Small Business (PIPE), which supports projects by tech firms and startups, and was launched in 1997. Both programs have been strengthened during Brito Cruz's term. This funding strategy has been reinforced by the creation of Engineering Research Centers (ERCs) in partnership with companies since 2015 and inspired the Communication Department to create "FAPESP Innovative R&D" (*Pesquisa para Inovação*), a channel for interaction with researchers and entrepreneurs.

This weekly newsletter with articles on the results of research projects funded via PIPE, PITE and the ERC programs has been distributed since 2016 to entrepreneurs supported by FAPESP and members of the São Paulo State Center for Industry (CIESP), the São Paulo State Association of Micro and Small Industrial Companies (SIMPI), the National Association for Research and Development in Innovative Companies (ANPEI) and technology parks, among others. Monitoring of the number of page views indicates an average of 4,000 readers per week, counting only hits via the newsletter emailed by FAPESP, as other entrepreneurs are reached via their respective associations.

In little more than a year since *Pesquisa para Inovação* was launched, it has proved not just a channel for news stories about innovative research but also a networking aid to entrepreneurs with similar initiatives and a showcase for the products developed by startups, many of which say they have connected to prospective customers through the newsletter. Brito Cruz asked the Communication Department to undertake an in-depth study of this function of the newsletter, so that more value can be added to communication with small enterprises if it is indeed effective in these ways.

"Professor Brito's files"

The Communication Department's publications section also has expanded during Brito Cruz's term. In addition to the Foundation's *Annual Report*, several books have been published such as *Science, Technology and Innovation Indicators in the State of São Paulo, Brazil* (2005, 2010, 2012); *Flight Plan for Aviation Biofuels in Brazil: Action Plan*, about a partnership among Boeing, Embraer and FAPESP; *PIPE 20 Years: The History of Brazil's Leading Program in Support of Innovative Small Companies*, commemorating two decades of PIPE; *FAPESP 50 Years: Half a Century of Science* by Shozo Motoyama; and *Circa 1962* by Mônica Teixeira, commemorating FAPESP's fiftieth anniversary, to take only a few examples.

At the same time, between 2005 and 2019 the Communication Department issued dozens of publications in Portuguese and English, with abstracts of research projects supported by FAPESP via its various programs.

Production of this material – known as "Professor Brito's files" because of its format – involved reporters, editors, designers, layout artists, translator and proofreaders all the way to approval by the Scientific Director before it was sent to the printers.

For example, *Translating Research into Business – Ten Years Promoting Technological Innovation* (the original in Portuguese was published in 2005, with English and French translations) presented information on 435 PIPE projects and 81 PITE projects.

Brazil, World Leader in Sugarcane and Ethanol Knowledge and Technology: FAPESP's Contribution summarized in Portuguese and English all projects in this field supported by the Foundation between 1997 and 2007.

In 2008, five publications were issued with abstracts of projects funded by programs such as BIOTA-FAPESP, Climate Change, Health Research (106 abstracts in 13 sub-areas) and Biodiversity, as well as projects by the then 11 RIDCs.

In 2012, seven similar publications were issued and since 2013 these publications have become sporadic because of the rising number of portal and BV pages devoted to the programs.

For more effective communication with academia, society and government

The advance of PIPE, the four annual editions of PIPE's Program of Training in High-Tech Entrepreneurship (PIPE Entrepreneur) from 2017, FAPESP Week and dozens of seminars, workshops and other meetings held by the Foundation have required reinforcement of the Communication Department, which is responsible for organizing events: the number held in 2019 was 102, up from 70 in 2016 and 24 in 2005.

Among the events organized in 2019, a standout was the 8th Annual Meeting of the Global Research Council (GRC), which brought to São Paulo (and for the first time to Brazil) the heads of funding agencies in 50 countries on all five continents. The meeting took place on May 2-3, 2019, and was organized by the German Research Foundation (DFG), Argentina's National Council for Scientific and Technical Research (CONICET), and FAPESP.

At the meeting, during which Brito Cruz was elected Chair of the GRC's Governing Board, the Council took a position on the expectations of funding agencies and governments that support for scientific research should promote solutions to the world's economic and societal challenges. A Statement of Principles was approved advocating a balance between basic research and applied or use-oriented research when funders select projects, with merit prevailing as a priority, and recommending the adoption of more effective communication strategies to raise awareness of the results of funded research projects on the part of the research community, society and government.

The GRC's recommendation leaves no doubts about the strategic role of communication for research funding agencies, or about the daunting challenge of publicizing science and technology in a country ranked 67th out of 79 countries by PISA, the OECD's Program for International Student Assessment. Based on the results achieved in recent years, however, FAPESP appears to be on the right track.

Appendix I – Authors

Ademar Seabra, Ministry of Foreign Relations, Brazil, 25

Achilles Zaluar, Ministry of Foreign Relations, Brazil, 25

Alexandra Ozorio de Almeida, *Pesquisa FAPESP,* 176

Alexandre Roccatto, São Paulo Research Foundation (FAPESP), 147

Alejandro Zurita, Minister Counsellor Science, Technology & Innovation, 41

Américo Martins Craveiro, 90

Ana Maria Fonseca de Almeida, University of Campinas (UNICAMP), 96

Ana Paula Yokosawa, São Paulo Research Foundation (FAPESP), 147

Anamaria Aranha Camargo, Sírio-Libanês Hospital, 81

Bruna Musa, São Paulo Research Foundation (FAPESP), 147

Carlos Alfredo Joly, Institute of Biology/ University of Campinas (IB/UNICAMP), 123

Carlos Américo Pacheco, São Paulo Research Foundation (FAPESP), 19

Carlos Eduardo Negrão, School of Physical Education and Sports/University of São Paulo (EEFE/USP), 81

Carolina Costa, São Paulo Research Foundation (FAPESP), 147

Claudia Bauzer Medeiros, Institute of Computing/University of Campinas (IC/UNICAMP), 129

Claudia Izique, São Paulo Research Foundation (FAPESP), 180

Cristina Hori, British Consulate-General in Sao Paulo, 48

Diego Arruda, Science and Innovation Network, Newton Fund, 48

Douglas Eduardo Zampieri, Faculty of Mechanical Engineering/University of Campinas (FEM/UNICAMP), 90

Euclides de Mesquita Neto, Faculty of Mechanical Engineering/University of Campinas (FEM/UNICAMP), 98

Evaldo F. Vilela, Brazilian National Council of State Funding Agencies (CONFAP), 64

Fábio Kon, Institute of Mathematics and Statistics/University of São Paulo (IME/USP), 90

Fernanda Biondi, São Paulo Research Foundation (FAPESP), 157

Fernando Menezes de Almeida, São Paulo Research Foundation (FAPESP), 19

France Córdova, National Science Foundation (NSF), 31

Francisco Antônio Bezerra Coutinho, School of Medicine/University of São Paulo (FM/USP), 85

Francisco Laurindo, School of Medicine/University of São Paulo (FM/USP), 81

Gilberto Câmara Neto, National Institute for Space Research (INPE), 132

Gilberto de Martino Jannuzzi, Interdisciplinary Center of Energy Planning/University of Campinas (NIPE/UNICAMP), 132

Glaucia Mendes Souza, Chemistry Institute/ University of São Paulo (IQ/USP), 119

Heitor Cantarella, Agronomic Institute of Campinas (IAC), 119

Heitor Shimizu, São Paulo Research Foundation (FAPESP), 180

Hernan Chaimovich, Chemistry Institute/University of São Paulo (IQ/USP), 104

Humberto Ribeiro da Rocha, Institute of Astronomy, Geophysics and Atmospheric Science/University of São Paulo (IAG/USP), 132

Ignacio Ybáñez, European Union, 41

Isnard Magnus, São Paulo Research Foundation (FAPESP), 157

Jean Paul Metzger, Institute of Biosciences/University of São Paulo (IB/USP), 123

Jean Pierre Henry Balbaud Ometto, National Institute for Space Research (INPE), 132

Joaquim José de Camargo Engler, São Paulo Research Foundation (FAPESP), 19

Jorge G. Tezon, National Research Council (CONICET), 56

José A. Brum, "Gleb Wataghin" Institute of Physics/University of Campinas (IFGW/UNICAMP), 112

José Roberto de França Arruda, Faculty of Mechanical Engineering/University of Campinas (FEM/UNICAMP), 85

José Roberto Postali Parra, Higher School of Agriculture "Luiz de Queiroz"/University of São Paulo (ESALQ/USP), 81

Luciano Martins Verdade, Center of Nuclear Energy in Agriculture/University of São Paulo (CENA/USP), 123

Lucio Angnes, Chemistry Institute/University of São Paulo (IQ/USP), 90

Luis Cassinelli, 119

Luis Fernando Artoni Junior, São Paulo Research Foundation (FAPESP), 153

Luiz Augusto Horta Nogueira, Interdisciplinary Center of Energy Planning/University of Campinas (NIPE/UNICAMP), 119

Luiz Henrique Lopes dos Santos, School of Philosophy, Literature and Human Sciences/University of São Paulo (FFLCH/USP), 96 and 176

Luiz Nunes de Oliveira, São Carlos Institute of Physics/University of São Paulo (IFSC/USP), 107

Marcelo Knobel, University of Campinas (UNICAMP), 71

Marco Antonio Zago, São Paulo Research Foundation (FAPESP), 13

Maria Julia Manso Alves, Chemistry Institute/University of São Paulo (IQ/USP), 81

Marie Anne Van Sluys, Institute of Bioscience/University of São Paulo (IB/USP), 81

Marilda Solon Teixeira Bottesi, São Paulo Research Foundation (FAPESP), 139

Marina Marmontel Leite do Canto, São Paulo Research Foundation (FAPESP), 153

Melanie Welham, Biotechnology and Biological Sciences Research Council (BBSRC/UKRI), 53

Molapo Qhobela, National Research Foundation (NRF) of South Africa, 58

Neldson Marcolin, *Pesquisa FAPESP*, 176

Patrícia Morellato, Institute of Bioscience/ São Paulo State University (IB/UNESP), 132

Patrícia Tambourgi, São Paulo Research Foundation (FAPESP), 147

Patrícia Tedeschi, São Paulo Research Foundation (FAPESP), 147

Paula Montero, The Brazilian Center of Analysis and Planning (CEBRAP), 96

Paulo Eduardo Artaxo Netto, Physics Institute/University of São Paulo (IF/USP), 132

Peter Strohschneider, German Research Foundation (DFG), 36

Regina Lúcia B. da Costa de Oliveira, São Paulo Research Foundation (FAPESP), 147

Renato Atílio Jorge, São Paulo Research Foundation (FAPESP), 139

Renato H. L. Pedrosa, Institute of Geosciences/University of Campinas (IGE/UNICAMP), 167

Ricardo de Oliveira Anido, University of Campinas (UNICAMP), 75

Roberto de Alencar Lotufo, University of Campinas (UNICAMP), 75

Roberto Gomes de Souza Berlinck, São Carlos Institute of Chemistry/University of São Paulo (IQSC/USP), 123

Roberto Marcondes Cesar Junior, Institute of Mathematics and Statistics/University of São Paulo (IME/USP), 85

Rosaly F. Krzyzanowski, São Paulo Research Foundation (FAPESP), 161

Rubens Maciel Filho, Faculty of Chemistry Engineering/University of Campinas (FEQ/UNICAMP), 119

Sergio Luiz Monteiro Salles Filho, Institute of Geosciences/University of Campinas (IGE/UNICAMP)

Sérgio Robles Reis de Queiroz, Institute of Geosciences/University of Campinas (IGE/UNICAMP), 90

Simone A. Vieira, Center for Environmental Studies and Research/University of Campinas (NEPAM/UNICAMP), 123

Simone Godoi, São Paulo Research Foundation (FAPESP), 147

Sir Mark Walport, UK Research and Innovation (UKRI), 33

Stan Gielen, Dutch Research Council (NWO), 44

Ted Hewitt, Social Sciences and Humanities Research Council of Canada, 61

Thais de Souza Costa Molari, São Paulo Research Foundation (FAPESP), 153

Tim Willis, Biotechnology and Biological Sciences Research Council (BBSRC/UKRI), 53

Vanderlan Bolzani, Chemistry Institute/ São Paulo State University (IQ/UNESP), 123

Vijay Rangarajan, British Embassy, 48

Virginia Subiñas, São Paulo Research Foundation (FAPESP), 147

Wagner Caradori do Amaral, Faculty of Eletric Engineering and Computing/ University of Campinas (FEEC/UNICAMP), 85

Walter Colli, Chemistry Institute/University of São Paulo (IQ/USP), 81

Watson Loh, Chemistry Institute/University of Campinas (IQ/UNICAMP), 112

Appendix II

COLLABORATION AND CO-FUNDING IN RESEARCH

Agencies, Academic Institutions and Companies

UNTIL FEBRUARY, 2020

AFRICA	
Cabo Verde	• Ministério da Educação Superior, Ciência e Inovação (MESCI)
Mozambique	• Fundo Nacional de Investigação (FNI)
South Africa	• National Research Foundation (NRF) • Stellenbosch University • University of Cape Town (UCT)
ASIA	
China	• Fundação Nacional de Ciências Naturais da China (NSFC) • Pekin University • Tianjin University (TJU) • Zhejiang University (ZIU)
Iran	• Cognitive Science and Technology Council of Iran (CSTC)
Israel	• Matimop • Technion - Instituto de Tecnologia de Israel • Tel Aviv University • The Hebrew University of Jerusalem • University of Haifa • Weizmann Institute of Science
Japan	• Japan Science and Technology Agency (JST) • Japan Society for the Promotion of Science (JSPS) • Hiroshima University • University of Tokyo • University of Tsukuba
Singapore	• National University Singapore (NUS)
South Korea	• National Research Foundation of Korea (NRF)
Russian	• Russian Federation for Basic Research

CENTRAL AMERICA	
Cuba	• Ministério de Educação Superior da República de Cuba • Ministério de Intervenciones y Colaboracion Econômica
EUROPE	
Austria	• Universit of Natural Resources and Life Science
Belgium	• Direction Générale Opérationnelle Economie, Emploi & Recherche du Service Public de Wallonie (DGO6/ex-DGOERR) • Eureka Network • Fonds de la Recherche Scientifique (F.R.S.- FNRS) • Research Foundation - Flanders (FWO) • Solvay
Czech Republic	• Czech Science Foundation (GACR) • Technology Agency of the Czech Republic
Denmark	• Danish Agency for Science and Higher Education (DAFSHE) • Innovation Fund Denmark (ex-DCSR) • University of Copenhagen
Finland	• Academy of Finland (AKA)
France	• Agence Nationale de la Recherche (ANR) • Agence Nationale de la Recherche (ANR)/FACEPE • BioEvents SAS - Biovision • Centre de Coopération Internationale en Recherche Agronomique pour le Développment (Cirad) • Centre National de la Recherche Scientifique (CNRS) • Ecole des Hautes Études en Sciences Sociales (EHESS) • Ecole Normale Supérieure (ENS) • Groupe des Écoles Centrales (GEC) • Institut National de la Recherche Agronomique (Inra) • Institut National de la Santé et de la Recherche Médicale (Inserm) • Institut National de Recherche en Informatique et en Automatique (Inria) • Institut Pasteur • ParisTech • Peugeot Citröen • Région Provence-Alpes-Côte d'Azur • Sorbonne Universités • Université de Lyon • Université Grenoble Alpes
Germany	• Bavarian State Ministry of Science and the Arts of the Free State of Bavaria (StMWK) • CORNET • DAAD/DWIH-SP (German House of Science and Innovation) • Deutsche Forschungsgemeinschaft (DFG) • Federal Ministry of Education and Research (BMBF) • Fraunhofer-Gesellschaft • Friedrich-Alexander-Universität Erlangen-Nürnberg • German Academic Exchange Service (DAAD) • Max Planck Society for the Advancement of Science • Serviço Alemão de Intercâmbio Acadêmico 2018 (DAAD) • Technishe Universität München

	• University of Münster • Universität Hamburg
Ireland	• Irish Research Council (IRC) • Science Foundation Ireland
Italy	• Consiglio Nazionale delle Richerche (CNR) • Italian Universities and CONFAP (MCI) • Scuola Normale Superiore • Università di Bologna
Netherland	• BE-BASIC • Delft University of Tecnhnology • Erasmus Universiteit Rotterdam • Koppert • Leiden University • Netherlands Organization for Scientific Research (NWO) • Stichting Dutch Polymer Institute (DPI) • Technische Universiteit Eindhoven (TU/e) • University of Twente
Norway	• Equinor • Research Council of Norway (RCN)
Portugal	• Fundação para a Ciência e a Tecnologia (FCT)
Spain	• Centro para el Desarrollo Tecnologico Industrial (CDTI) • Consejo Superior de Investigaciones Cientificas (CSIC) • Grupo Telefonica • Secretaría de Estado de Investigación, Desarrollo e Innovación (SEIDI) • Universidad Complutense de Madrid • Universidad Miguel Hernandéz de Elche • Universidat de Girona • Universidad de Salamanca
Sweden	• Halmstad University • Karolinska Institutet • Linköping University • Lund University • Swedish Research Council • Swedish Governmental Agency for Innovation Systems (Vinnova) • Uppsala University
Switzerland	• Ludwig Institute for Cancer Research • Swiss Federal Institute of Technology Zürich
United Kingdom	• AstraZeneca - MedImmune • Bangor University • BG E&P • BP Biocombustíveis SA • British Council/Newton Fund • British Council Research Links • Brunel University London • Cardiff University • Coventry University

- Famelab – British Council
- GlaxoSmithKline (GSK)
- GlaxoSmithKline (GSK) e Embaixada do Reino Unido da Grã-Bretanha e Irlanda do Norte
- GSK e Fundação Biominas
- GSK – Nobel Prize Lectures
- Heriot-Watt University
- Imperial College
- Imprimatur Capital
- Keele University
- King's College London
- London School of Economics and Political Science
- Programa Newton Fund-Grã Bretanha e Irlanda do Norte/CONFAP/FAPS
- Queen Mary University of London
- Queen's University of Belfast
- Royal Academy of Engineering
- Shell
- UK Academies and CONFAP
- UK Research and Innovation (UKRI) – BBSRC, NERC, MRC, ESRC
- University of Bath
- University of Birmingham
- University of Cambridge
- University of Durham
- University of East Anglia
- University of Edinburgh
- University of Exeter
- University of Glasgow
- University of Leeds
- University of London, Institute of Education
- University of Manchester
- University of Nottingham
- University of Oxford
- University of Southampton
- University of Stirling
- University of Surrey
- University of Warwick
- University of York
- Welcome Trust

NORTH AMERICA

Canada

- Agence Universitaire de la Francophonie (AUF)
- Canada's International Development Research Centre (IDRC)
- Carleton University
- Consortium Alberta, Laval, Dalhousie and Ottawa (CALDO)
- Fonds de Recherche du Quebec Société et Culture (FRQSC)
- International Science and Technology Partnerships Canada Inc. (ISTPCanada)
- McGill University
- McMaster University
- National Research Council of Canada (NRC)
- Natural Sciences and Engineering Research Council of Canada (NSERC)
- Queen's University at Kindston
- Simon Fraser University, Concordia University, York University and Ryerson University
- University of Ontario Institute of Technology
- University of Toronto

- University of Toronto and University of Western Ontario
- University of Victoria
- University of Waterloo

United States

- Agilent Technologies
- Boeing
- Brown University
- California Institute for Regenerative Medicine (CIRM)
- Case Western Reserve University
- Columbia Global Centers
- Columbia University (Nova York)
- Comissão Fulbright
- Duke University
- Emory University
- Fermilab
- Bill and Melinda Gates Foundation
- George Washington University
- IBM
- Intel
- John E. Fogarty International Center
- Marine Biological Laboratory (MBL)
- Massachusetts Institute of Technology (MIT)
- Microsoft Research
- Museum of Fine Arts, Houston
- National Institutes of Health (NIH)
- National Science Foundation (NSF) – CNIC
- National Science Foundation (NSF) – ICC
- National Science Foundation (NSF) – PIRE
- National Science Foundation (NSF) and Program on Materials World Network (MWN)
- National Science Foundation (NSF) – Dimensios of Biodiversity
- North Carolina State University
- Ohio State University
- Purdue University
- Pew Latin American Fellows Program in the Biomedical Sciences (PEW)
- Programa Dra. Ruth Cardoso (Fulbright/George Washington)
- Programa Dra. Ruth Cardoso (FAPESP/Fulbright/Georgetown University)
- Programa Dra. Ruth Cardoso (Capes/Fulbright/Universidade Columbia)
- Purdue University
- Smithsonian Institution
- Terremark
- Texas A&M University (TAMU)
- Texas Tech University (TTU)
- The Museum of Fine Arts, Houston
- The Scripps Research Institute
- University of California Davis
- University of California San Diego (UCSD)
- University of Central Florida (UCF)
- University of Florida
- University of Georgia
- University of Illinois
- University of Maryland
- University of Miami
- University of Michigan

- University of Missouri
- University of Nebraska - Lincoln
- University of North Carolina - Charlotte
- University of Southern California
- University of Texas, Austin
- University of Virginia
- US Department of Energy - GOAmazon
- UT-Battelle (Oak Ridge National Laboratory)
- Vanderbilt University
- West Virginia University (WVU)

Mexico
- Conselho Nacional de Ciência e Tecnologia dos Estados Unidos do México (CONACYT)
- Instituto de Innovación y Transferencia de Tecnología de Nuevo León

OCEANIA

Australia
- Australian National University (ANU)
- Australian Technology Network of Universities (ATN)
- Deakin University
- Macquarie University
- Queensland University of Technology (QUT)
- Swinburne University of Technology
- University of Melbourne
- University of New South Wales
- University of Queensland
- University of Sydney
- University of Wollongong
- Victoria University

New Zealand
- Universities New Zealand, Te Pokai Tara (UNZ)

SOUTH AMERICA

Argentina
- Consejo Nacional de Investigaciones Científicas y Técnicas (Conicet)
- Ministerio de Ciencia, Tecnología e Innovación Productiva (MINCyT) e USP: Projeto LLAMA

Brazil
- Andaraguá S.A.
- Apae de São Paulo
- Associação Brasileira da Indústria de Alta Tecnologia de Produtos para a Saúde (Abimed)
- Associação Brasileira de Pesquisa e Inovação Industrial (Embrapii)
- Banco Nacional de Desenvolvimento Econômico e Social (BNDES)
- Biolab
- Biozeus
- Braskem
- Centro Alemão de Ciência e Inovação de São Paulo (DWIH)
- Ci&T - Digital Assets
- Conselho de Defesa do Patrimônio Histórico, Arqueológico, Artístico e Turístico do Estado (Condephaat)
- Conselho Nacional das Fundações Estaduais de Amparo à Pesquisa (CONFAP)
- Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)
- Coord. de Aperfeiçoamento de Pessoal de Nível Superior (Capes)
- Copag
- Dedini Indústrias de Base
- Embaixada do Reino Unido da Grã Bretanha e da Irlanda do Norte
- Embraer

- Financiadora de Inovação e Pesquisa (Finep)
- Fundação Biominas
- Fundação de Amparo à Ciência e Tecnologia de Pernambuco (Facepe)
- Fundação de Amparo à Pesquisa do Estado de Minas Gerais (Fapemig)
- Fundação de Amparo à Pesquisa do Estado do Amazonas (Fapeam)
- Fundação de Amparo à Pesquisa do Estado de Rio de Janeiro (Faperj)
- Fundação de Amparo à Pesquisa e ao Desenvolvimento Científico e Tecnológico do Maranhão (Fapema)
- Fundação de Amparo à Pesquisa e Inovação do Espírito Santo (FAPES)
- Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina (Fapesc)
- Fundação de Amparo à Pesquisa do Estado da Paraíba (Fapesq)
- Fundação Getúlio Vargas (FGV)
- Fundação Grupo Boticário de Proteção à Natureza (FGB)
- Fundação Maria Cecília Souto Vidigal
- Fundação Padre Anchieta
- Fundação Sistema Estadual de Análise de Dados (Seade)
- German House of Science and Innovation (DWIH) - São Paulo
- GlaxoSmithKline Brasil (GSK)
- Grupo São Martinho
- Grupo Telefônica
- IBM Brasil
- Informática de Municípios Associados (IMA)
- Instituto de Estudos de Saúde Suplementar (IESS)
- Instituto Euvaldo Lodi (IEL/SP)
- Instituto Fleury
- Instituto Nacional de Pesquisas Espaciais (Inpe)
- Intel
- Ministério da Ciência, Tecnologia, Inovações e Comunicações
- Natura
- Nossa Caixa Desenvolvimento
- Odebrecht Agroindustrial
- Ouro Fino Saúde Animal
- Oxiteno
- Padtec
- Prefeitura Municipal de Jundiaí
- Sabesp
- Secretaria de Estado de Energia – Rede ER
- Secretaria de Governo do Estado de São Paulo
- Secretaria do Meio Ambiente – Fundação Florestal
- Secretaria Municipal de Inovação e Tecnologia de São Paulo
- Secretaria Municipal de Saúde de São Paulo
- Sindicato das Empresas de Compra, Venda, Locação e Administração de Imóveis Residenciais e Comerciais de São Paulo (Secovi-SP)
- Solvay
- União dos Produtores de Bioenergia (UDOP)
- Vale (with Fapemig and Fapespa)
- Vitae: Apoio à Cultura, Educação e Promoção Social
- Whirlpool

Chile

- Comisión Nacional de Investigación Científica y Tecnológica (Conycit)
- Universidad de Chile (UCH)
- Universidad de la Frontera
- Universidad de Magallanes (UMAG)

Colombia	• Universidad de Antioquia
Paraguay	• Consejo Nacional de Ciencia y Tecnología (CONACYT)
Peru	• Consejo Nacional de Ciencia, Tecnología e Innovación Tecnológica (CONCYTEC)
Uruguay	• Agencia Nacional de Investigación e Innovación de Uruguay (ANII) • Asociación de Universidades Grupo Montevideo (AUGM)

MULTINATIONAL AGENCIES

- Belmont Forum (IGFA)
- Biodiversa (EU-Co-fund)
- Brasil-União Europeia (CNPq/FAPESP) – Biocombustíveis de 2ª geração
- Colaboração Interamericana de Materiais (CIAM)
- Crops of the Future Collaborative
- EU-CELAC IG
- EU-LIFE
- Earth Biogenome Project
- European Organization for Nuclear Research (CERN)
- European Research Council (ERC) and CONFAP
- Foundation for Food and Agricultural Research (FFAR)
- Fundo Global para o Meio Ambiente (GEF)
- Global Alliance for Chronic Diseases (GACD)
- Global Research Collaboration for Infectious Disease Preparedness (GloPID-R)
- GMTO Corporation
- Incobra
- Inter-American Institute for Global Change Research (IAI)
- Inter American Network of Academies of Science (IANAS)
- International Institute for Apllied Systems Analysis (IIASA)
- International Union of Pure and Applied Chemistry (IUPAC)
- M-ERA.NET
- STIC-AmSud
- The New Partnership for Africa's Development (NEPAD)
- Trans-Atlantic Platform for the Social Sciences and Humanities
- União Europeia (Horizon 2020)
- Université de Montréal, Bruxelles e Genéve (G3)

MAP (inside backover)

Partnerships and Agreements of FAPESP in Brazil and Abroad

Research Funding Agencies, Higher Education, Research Institutes and Companies

PARTNERSHIPS AND AGREEMENTS IN BRAZIL AND ABROAD

Research Funding Agencies, Higher Education, Research Institutes and Companies

FAPESP
SÃO PAULO RESEARCH FOUNDATION

www.fapesp.br/agreements