R&D in the State of São Paulo, Brazil

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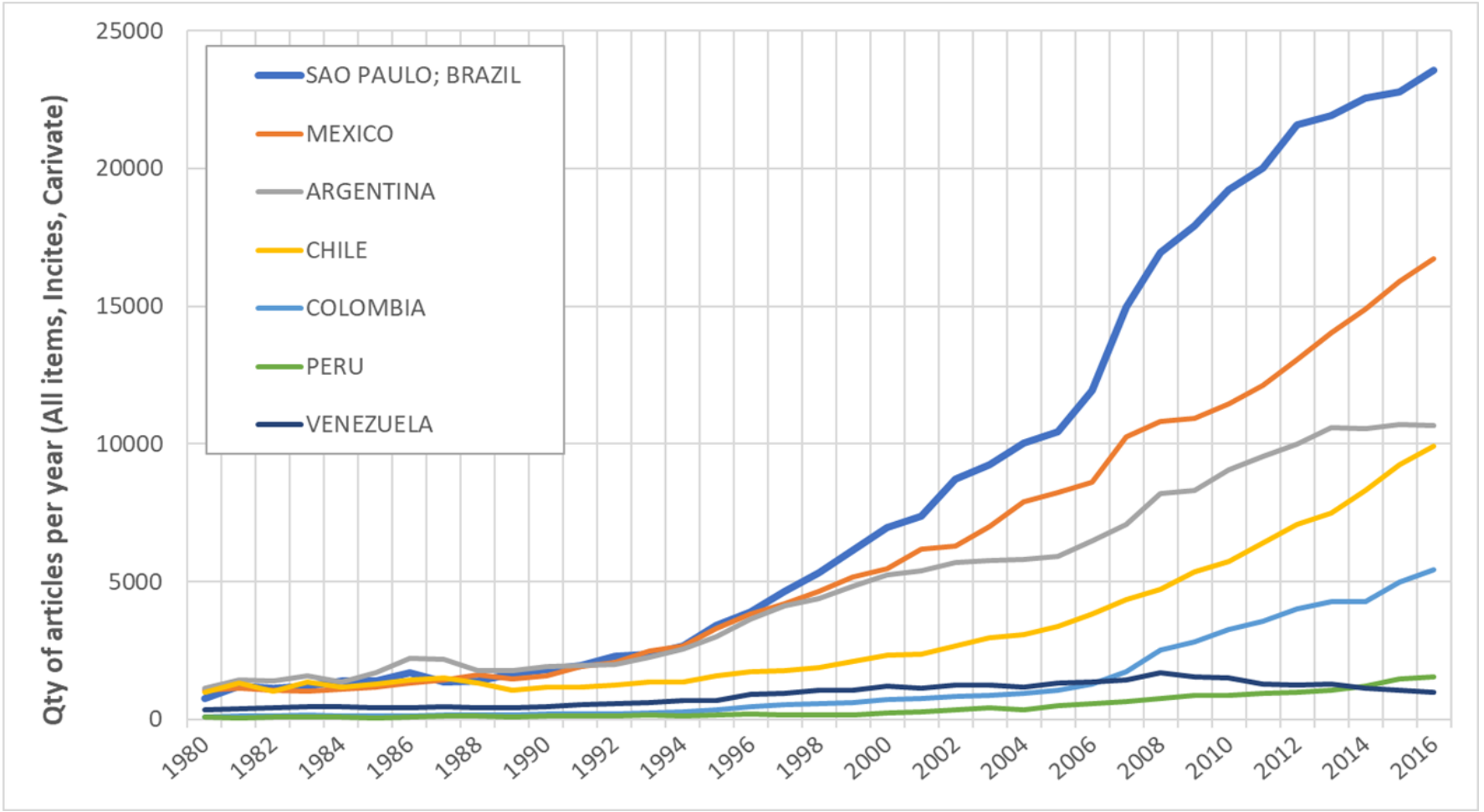
Science Director
FAPESP
FW CUNY, 20181126

R&D in São Paulo, Brazil

- A vigorous system for S&T and Innovation
  - Stable funding for research
  - Strong research universities
  - Largest science production in Latin America
- Business-University joint research
  - Federal tax incentives
  - Support for Start-ups & University-Business joint research
  - Universities that create start-ups
  - Interest from national and multinational companies

1.4%	of GDP for R&D
42	Million people
32%	of Brazil's GDP
43%	of Brazilian science
7,288	PhDs graduated in 2017

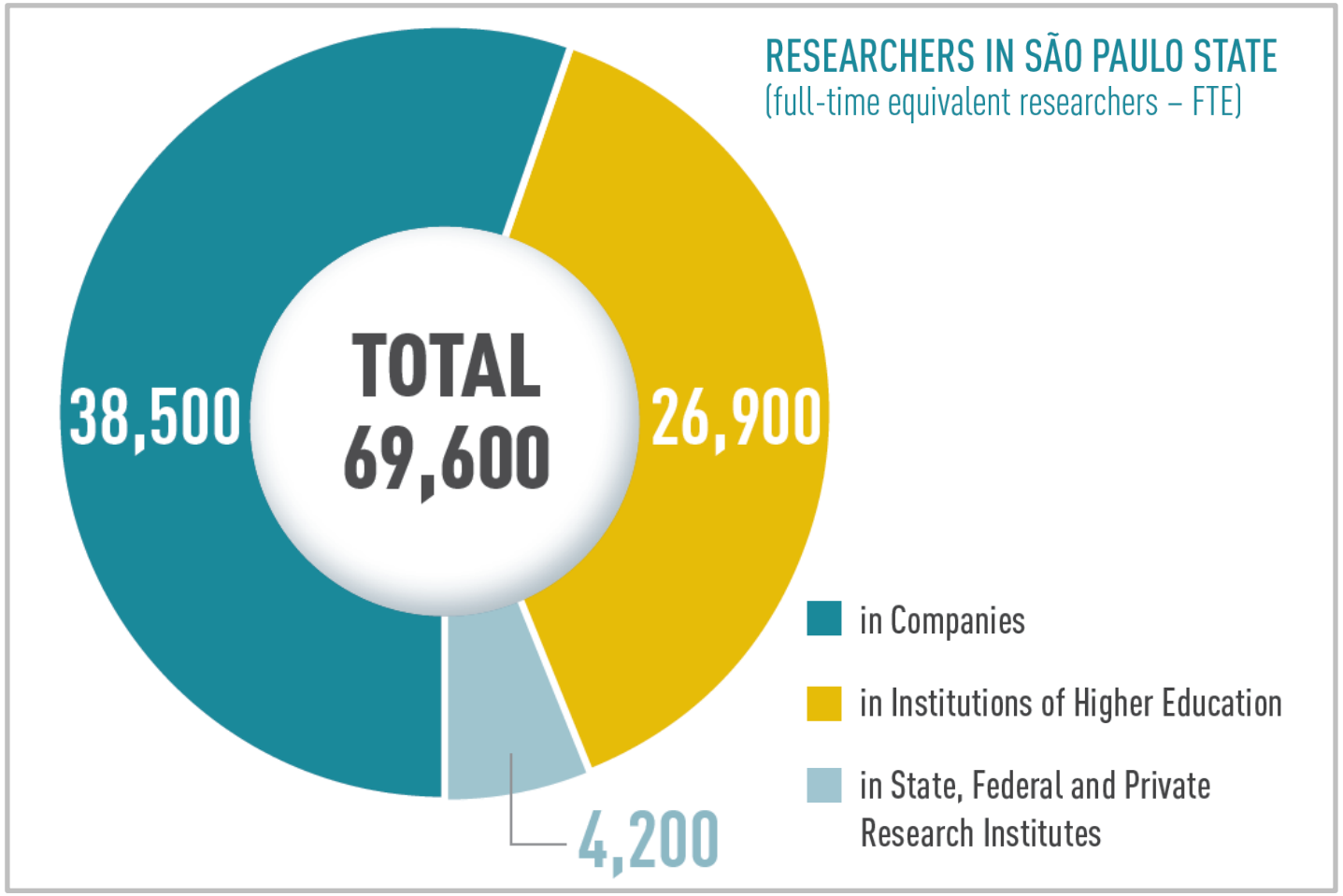
Researchers in São Paulo, Brazil publish more than colleagues from any Latin American country



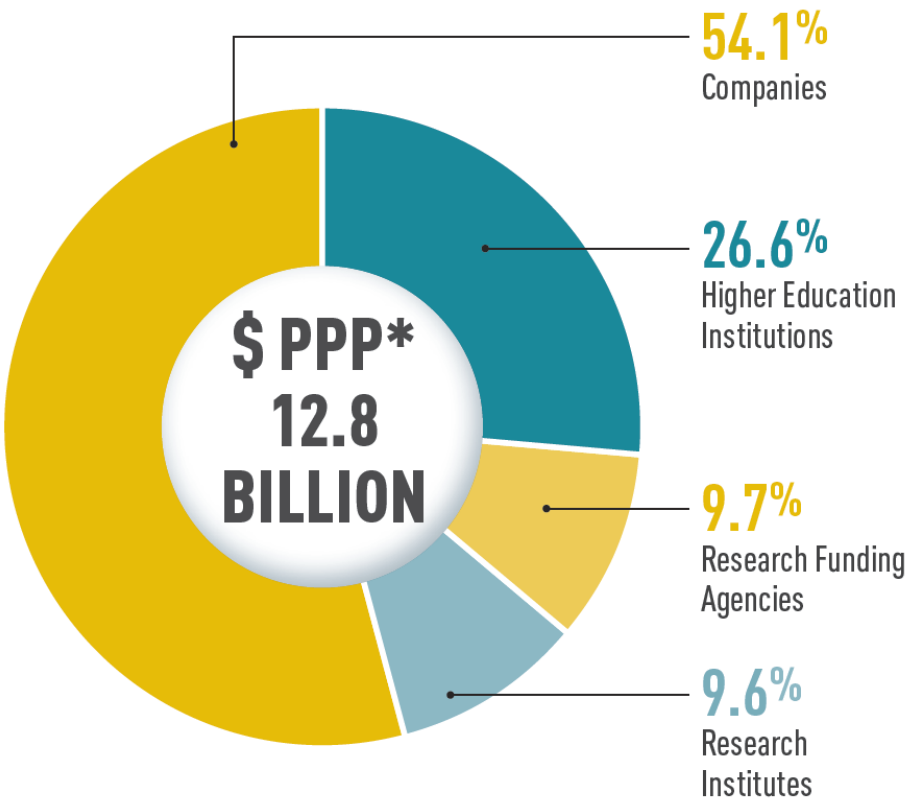
The S&T system in the state of São Paulo, 2017
151 entities, 15,000 companies, 69,600 researchers

151 institutions with mission guided to research activities and around **15,000 innovative companies**

- **6** Public Universities
  - 3 state
  - 3 federal
- **3** Other Public Institutions of Higher Education
  - 2 state
  - 1 federal
- **66** Technologies Schools
  - 65 state
  - 1 federal
- **21** Private Institutions of Higher Education
- **34** Research Institutes and S&T Institutions
  - 23 state
  - 11 federal (5 Embrapa Research Units)
- **21** Private Research Institutes
  - 9 linked to hospitals
  - 1 Federal Social Organization
  - 11 other
- **15,000** Innovative Companies



São Paulo: R&D expenditures, 2017

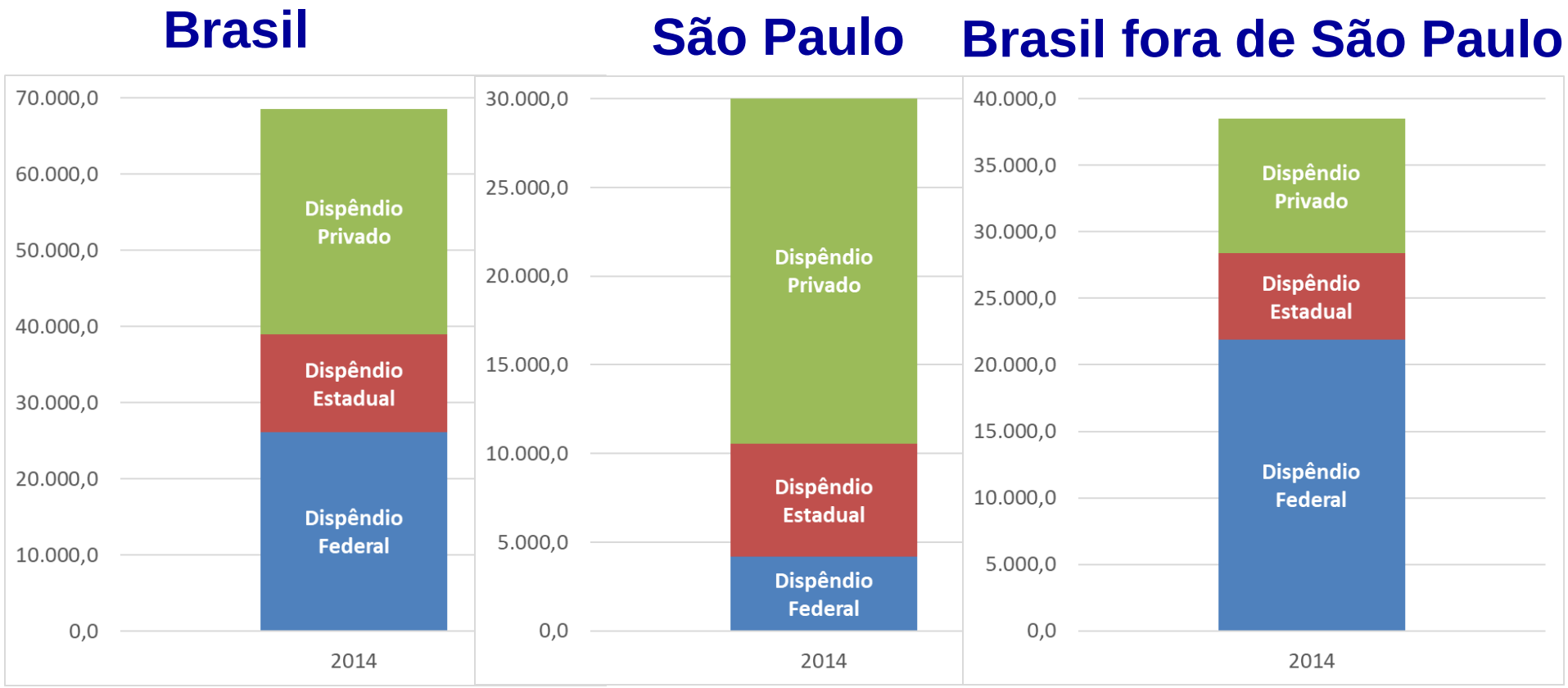


in $ PPP million

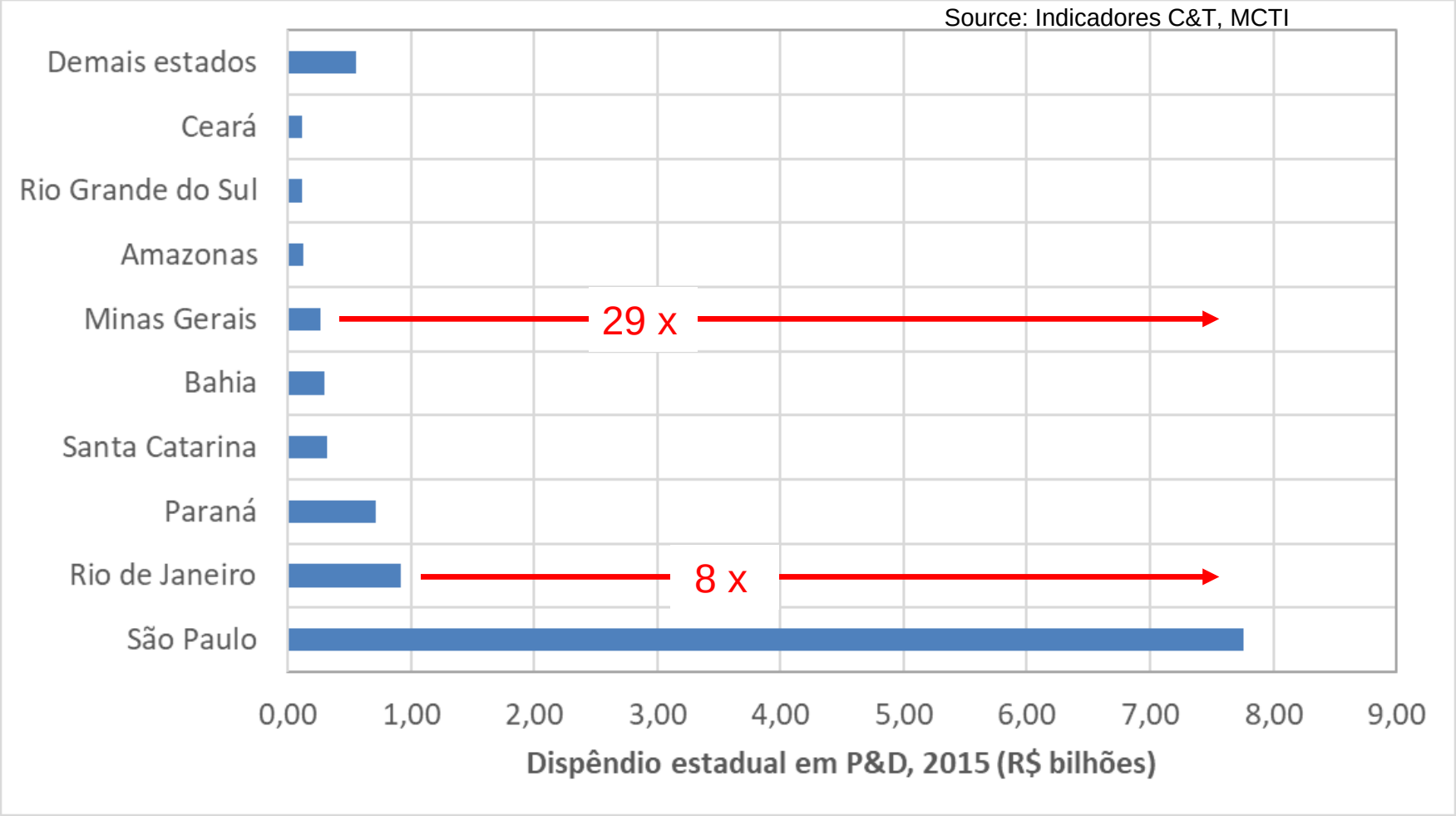
	2015	2016	2017
R&D IN SÃO PAULO STATE	12,880.7	12,885.6	12,754.8
Higher Education Institution (HEI)	3,291.1	3,497.4	3,390.8
HEI Federal	446.6	479.1	510.1
HEI State	2,574.2	2,710.2	2,574.3
HEI Private	270.3	308.1	306.4
Agencies for Research Funding	1,389.8	1,336.3	1,233.4
CNPq	258.9	178.9	156.0
Capes	364.1	399.1	370.4
Finep	178.3	215.2	182.9
FAPESP	588.5	563.1	524.1
Research Institutes	1,026.8	969.9	1,224.2
Federal Research Institutes	702.5	663.8	909.1
State Research Institutes	324.3	306.1	315.1
Companies	7,173.0	7,081.9	6,906.4

* Purchasing power parity (http://data.worldbank.org/indicator/pa.nus.ppp)
Note: For the methodology used to update R&D expenditure, see
Indicators of Science, Technology & Innovation in São Paulo 2010, FAPESP, 2011.

Brazil, São Paulo, Brazil outside São Paulo; 2014



Brazil: State R&D expenditures, 2015

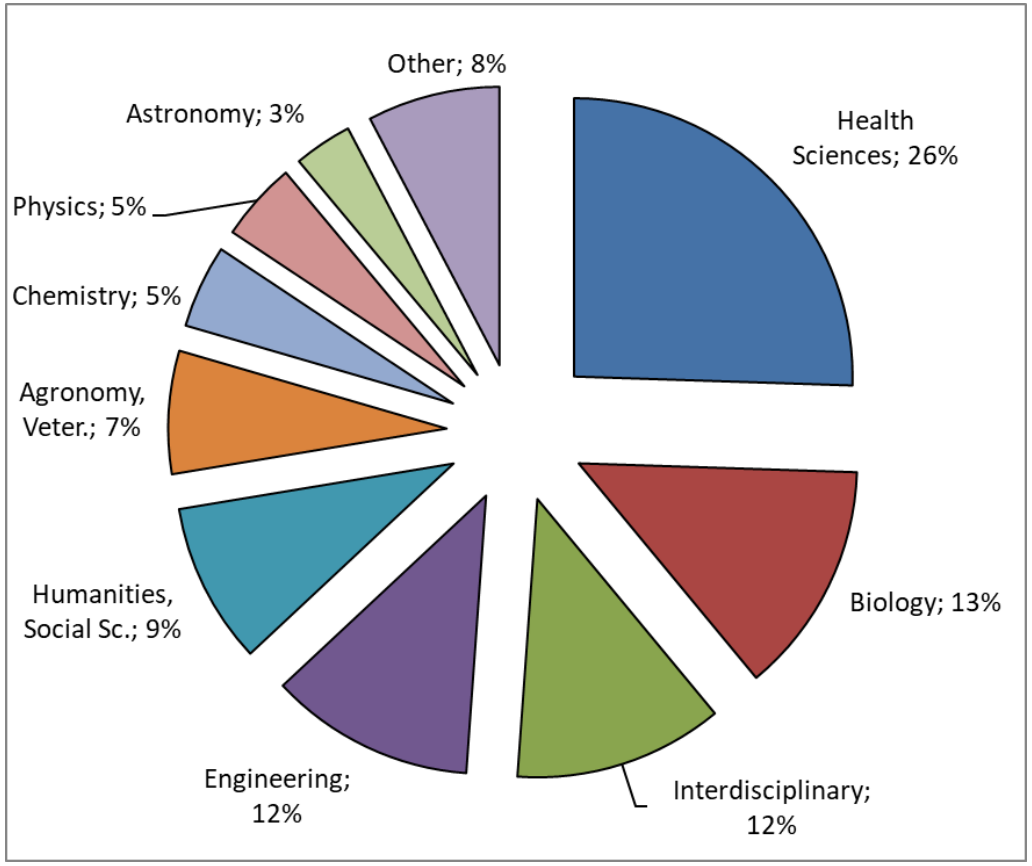


FAPESP: São Paulo Research Foundation

- Mission: support research in all fields
- Funded by the State of SP: 1% of all tax revenues
- All proposals are peer reviewed (26,000 in 2017)
  - Time for decision ~ 69 days; 41% success rate
- Annual budget: $PPP 520 million in 2017
  - Fellowships
    - In Brazil: 2,500 SI, 1,100 MSc, 2,400 DrSc, 2,000 Post-docs
    - Abroad: 1,200 per year
  - Academic R&D
    - 17 Centers (10 - 11 yrs dur.), 400 Thematic (5 yrs), 300 Young Investigators (4 yrs), 2,500 Regular (2 yrs)
  - University-Industry Joint R&D: Microsoft, Vale, Petrobrás, Embraer, Boeing, etc.
    - 14 Engineering Res. Centers: 10 years joint grants FAPESP/Industry – PCBA, GSK, Natura, BG,…
  - Small business R&D (PIPE): 1,500 SBE's (254 awards in 2017, one per workday, mostly start-ups)

FAPESP expenditures by field, 2017
Total: US$ 530 million (PPP)

Expenditures by field



Strategic programs

- BIOTA FAPESP: biodiversity research (1998)
  - 10+ univ./res. inst.; 300 PIs; 300 grants; 1,300+ students supported
- BIOEN: bioenergy (2009; focus on sugarcane bioethanol)
  - 10+ universities/res. inst.; 300 PIs; 230 grants; 500+ students
- PFPMCG: Global Climate Change (2009)
  - 10+ univ./res. inst.; 170 PIs; 150 grants; 250+ students
- e-Science and Data Science (2015)
  - 08+ univ/res. inst; 20 Pis; 15 grants; 40+ students

What we are looking for in S&T in São Paulo: impact in three dimensions

- Social impact
  - Ideas that increase well being, assist or inform public policy, increase the benefit from public goods
- Economic impact
  - Ideas that lead to new businesses
  - Ideas that increase economic competitiveness
  - Ideas that originate new industry sectors
- Intellectual impact
  - Ideas that originate more ideas
  - Ideas that make humankind wiser
  - Ideas strongly cited in the literature

Optical observation of signals associated to Gravitational Waves

The Astrophysical Journal Letters, 848:L12 (59pp), 2017 October 20 https://doi.org/10.3847/2041-8213/aa91c9

OPEN ACCESS

Multi-messenger Observations of a Binary Neutron Star Merger*

LIGO Scientific Collaboration and Virgo Collaboration, Fermi GBM, INTEGRAL, IceCube Collaboration, AstroSat Cadmium Zinc Telluride Imager Team, IPN Collaboration, The Insight-HXMT Collaboration, ANTARES Collaboration, The Swift Collaboration, AGILE Team, The 1M2H Team, The Dark Energy Camera GW-EM Collaboration and the DES Collaboration, The DLT40 Collaboration, GRAWITA: GRAvitational Wave Inaf TeAm, The Fermi Large Area Telescope Collaboration, ATCA: Australia Telescope Compact Array, ASKAP: Australian SKA Pathfinder, Las Cumbres Observatory Group, OzGrav, DWF (Deeper, Wider, Faster Program), AST3, and CAASTRO Collaborations, The VINROUGE Collaboration, MASTER Collaboration, J-GEM, GROWTH, JAGWAR, Caltech-NRAO, TTU-NRAO, and NuSTAR Collaborations, Pan-STARRS, The MAXI Team, TZAC Consortium, KU Collaboration, Nordic Optical Telescope, ePESSTO, GROND, Texas Tech University, SALT Group, TOROS: Transient Robotic Observatory of the South Collaboration, The BOOTES Collaboration, MWA: Murchison Widefield Array, The CALET Collaboration, IKI-GW Follow-up Collaboration, H.E.S.S. Collaboration, LOFAR Collaboration, LWA: Long Wavelength Array, HAWC Collaboration, The Pierre Auger Collaboration, ALMA Collaboration, Euro VLBI Team, Pi of the Sky Collaboration, The Chandra Team at McGill University, DFN: Desert Fireball Network, ATLAS, High Time Resolution Universe Survey, RIMAS and RATIR, and SKA South Africa/MeerKAT
(See the end matter for the full list of authors.)

Political Science: the inner workings of Brazilian democracy

The City University of New York

Presidential Power, Legislative Organization, and Party Behavior in Brazil

Argelina Cheibub Figueiredo and Fernando Limongi

Presidential regimes are considered to be prone to produce institutional deadlocks. In the generally shared view, influenced by the work of Juan Linz, presidentialism lacks a built-in mechanism to induce cooperation between the executive and legislative branches of the government.[1] Representatives and the president have different constituencies, and their mandates are independent and fixed. Hence the chances that the legislative and the executive powers will have the same agenda are small.

Personalized medicine

www.impactjournals.com/oncotarget/ Oncotarget, Advance Publications 2015

The use of personalized biomarkers and liquid biopsies to monitor treatment response and disease recurrence in locally advanced rectal cancer after neoadjuvant chemoradiation

Paola Carpinetti[1,2,3], Elisa Donnard[1,2,3], Fabiana Bettoni[2], Paula Asprino[2], Fernanda Koyama[1], Andrei Rozanski[2], Jorge Sabbaga[4], Angelita Habr-Gama[5,6], Raphael B. Parmigiani[2], Pedro A.F. Galante[2], Rodrigo O. Perez[1,5,6], Anamaria A. Camargo[1,2]

[1]Ludwig Institute for Cancer Research, São Paulo, SP, Brazil

[2]Centro de Oncologia Molecular Hospital Sírio Libanês, São Paulo, Brazil

[3]Programa de Pós Graduação em Bioquímica, Instituto de Química, Universidade de São Paulo, SP, Brazil

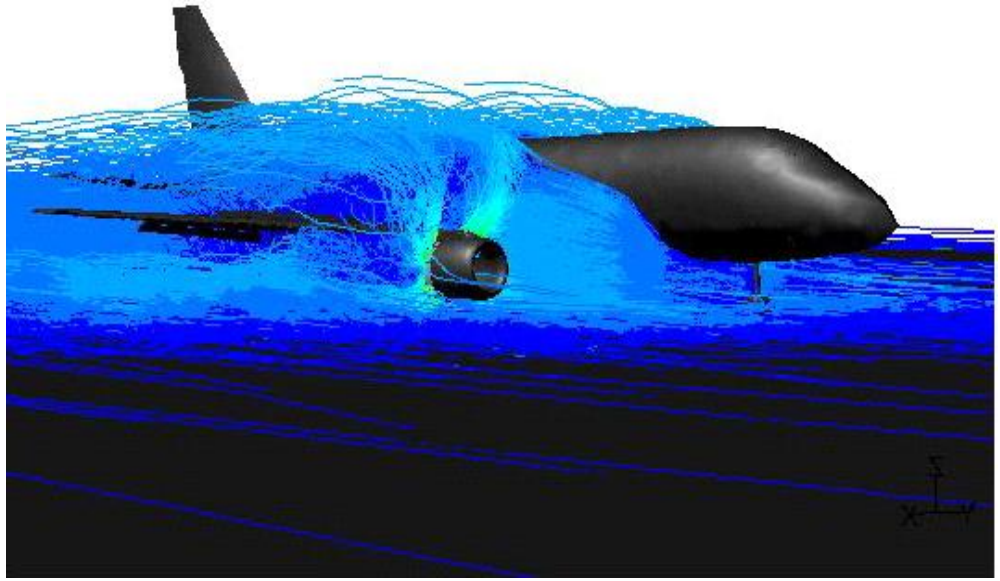
[4]Centro de Oncologia Clínica, Hospital Sírio Libanês, São Paulo, SP, Brazil

[5]Angelita & Joaquim Gama Institute, São Paulo, SP, Brazil

[6]University of São Paulo, School of Medicine, São Paulo, SP, Brazil

Correspondence to:
Anamaria A. Camargo, **e-mail:** aacamargo@mochsl.org.br

Embraer-FAPESP: R&D to build an innovative jet



Computational Fluid Dynamics (CFD) simulation and tests

Research co-funded by FAPESP, involving several universities

Basic research applied to real problems

FINANCIAL TIMES

Zika Virus + Add to myFT

Brazilian team finds clue to congenital Zika syndrome

Mayana Zatz's work on twins shows a genetic component to the birth defect

Andres Schipani in São Paulo FEBRUARY 28, 2018 5

Soon after the Zika epidemic broke out in Brazil, Mayana Zatz — an acclaimed geneticist who, for the preceding four decades had been tracking rare genetic disorders that destroy muscles — received a surprise phone call from the scientific director of a research foundation in São Paulo.

nature COMMUNICATIONS

Discordant congenital Zika syndrome twins show differential in vitro viral susceptibility of neural progenitor cells

Luiz Carlos Caires-Júnior, Ernesto Goulart, Uirá Souto Melo, Bruno Silva Henrique Araujo, Lucas Alvizi, Alessandra Soares-Schanoski, Danyllo Felipe de Oliveira, Gerson Shigeru Kobayashi, Karina Griesi-Oliveira, Camila Manso Musso, Murilo Sena Amaral, Lucas Ferreira daSilva, Renato Mancini Astray, Sandra Fernanda Suárez-Patiño, Daniella Cristina Ventini, Sérgio Gomes da Silva, Guilherme Lopes Yamamoto, Suzana Ezquina, Michel Satya Naslavsky, Kayque Alves Telles-Silva, Karina Weinmann, Vanessa van der Linden, Helio van der Linden, João Mendes Ricardo de Oliveira, Nivia Rodrigues Maria Arrais, Adriana Melo, Thalita Figueiredo, Silvana Santos, Joanna Castro Goes Meira, Saulo Duarte Passos, Roque Pacheco de Almeida, Ana Jovina Barreto Bispo, Esper Abrão Cavalheiro, Jorge Kalil, Edécio Cunha-Neto, Helder Nakaya, Robert Andreata-Santos, Luis Carlos de Souza Ferreira, Sergio Verjovski-Almeida, Paulo Lee Ho, Maria Rita Passos-Bueno & Mayana Zatz - Show fewer authors

Cranial reconstruction with Additive Manufacturing

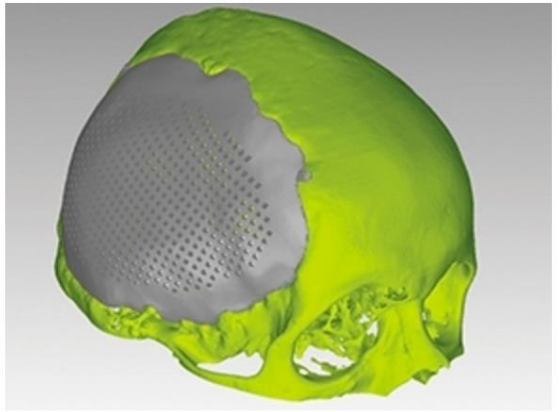
ELSEVIER

Journal of Cranio-Maxillofacial Surgery

Volume 42, Issue 8, December 2014, Pages 1877-1884

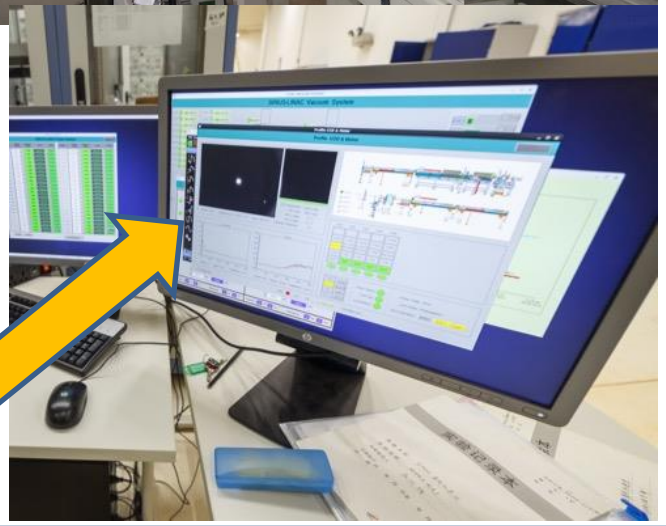
Cranial reconstruction: 3D biomodel and custom-built implant created using additive manufacturing

André Luiz Jardini [a, b], Maria Aparecida Larosa [a, b], Rubens Maciel Filho [a, b], Cecília Amélia de Carvalho Zavaglia [a, c], Luis Fernando Bernardes [a, b], Carlos Salles Lambert [a, d], Davi Reis Calderoni [a, e], Paulo Kharmandayan [a, e]



Projeção da prótese a partir do modelo 3D (*imagem: INCT-Biofabris*)

SIRIUS, Brazilian Synchrotron Light Source: LINAC and Booster inaugurated on Nov , 2018



Research about the Amazon

HOME ABOUT PROGRAM REGISTRATION DIRECTIONS PUBLICATIONS

http://fapesp.br/amazonsymposium/category/public

PUBLICATIONS

Science of the Amazon

The São Paulo Research Foundation (FAPESP) has beer
providing continuous support to research projects that stu
[…]

FAPESP-U.S. COLLABORATIVE RESEARCH ON THE AMAZON

There will be a live webcast of the symposium on October 28 at: www.wilsoncenter.org/event/fapesp-us-collaborative-research-the-amazon

The São Paulo Research Foundation (FAPESP) and the United States Department of Energy Office of Science, in partnership with the Wilson Center's Brazil Institute, cordially invite you to an all-day symposium on collaborative research projects led by scientists in the state of São Paulo, Brazil and in the U.S. targeting the discovery of new science about the Amazon.

The presentations will include the projects that are part of the Green Ocean Amazon (GOAmazon) research initiative, as well as other FAPESP partnerships.

Venue: Wilson Center – Washington – DC
One Woodrow Wilson Plaza
1300 Pennsylvania Ave. NW
Date: October 28th – 8:30AM

U.S. Secretary of Energy, Ernest Moniz, will keynote the event.

GO Amazon is financed by the U.S. DOE, FAPESP and the Amazon Research Foundation (FAPEAM), among other partners.

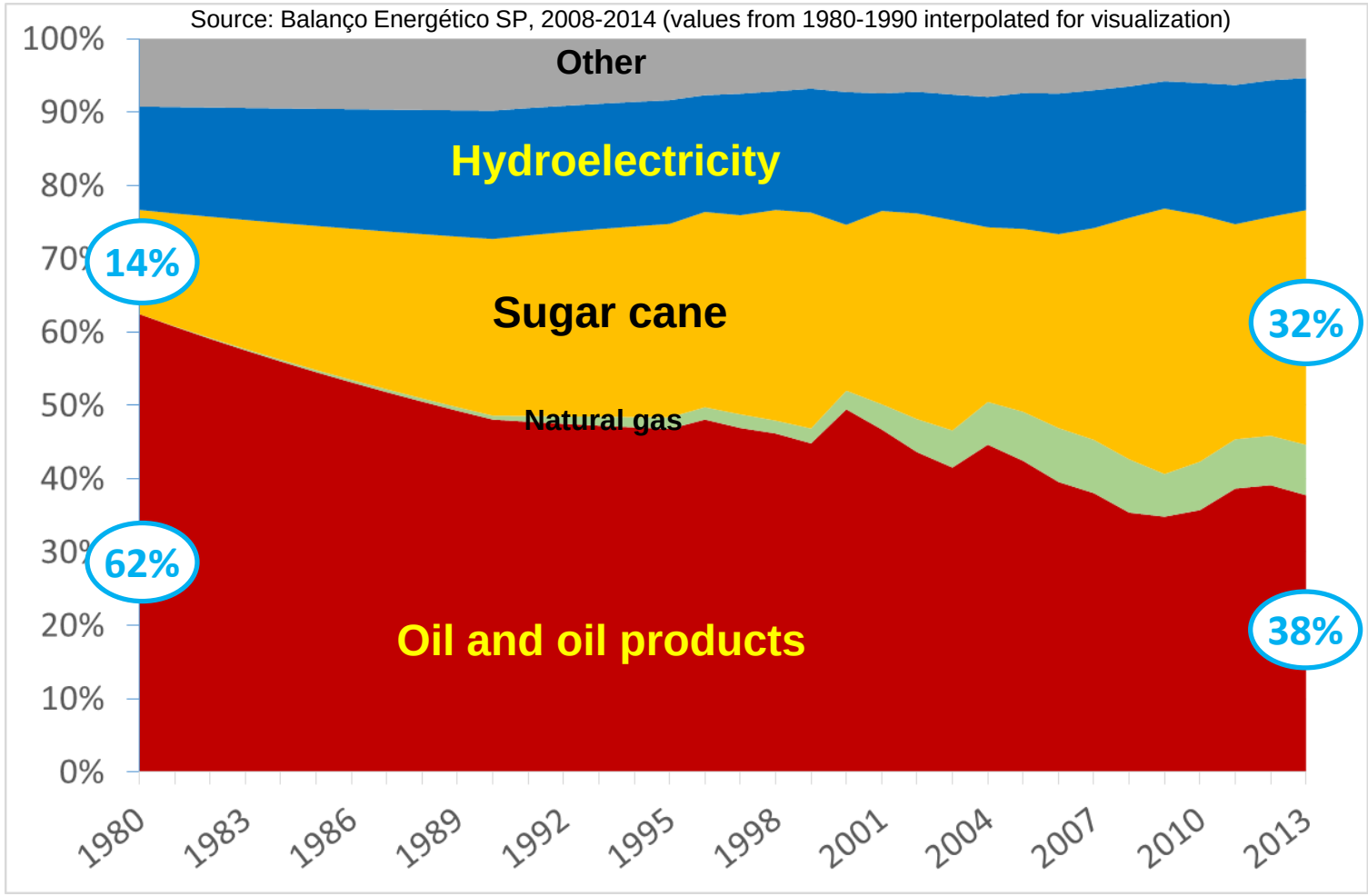
1980-2013: change in energy sources in the State of São Paulo, Brazil

State of São Paulo

- 42 million people
- 32% of Brazil's GDP
- 55% of Brazil's ethanol prod.

1980 – 2013

- Oil down from 62% to 38%
- Cane up from 14% to 32%
- Renewable at 50%



BIOEN – FAPESP's Bioenergy research

BIOEN has an impact in the International debate about bioenergy

Plant Biotechnology Journal

Plant Biotechnology Journal (2010) **8**, pp. 263–276 doi: 10.1111/j.1467-7652.2009.00491.x

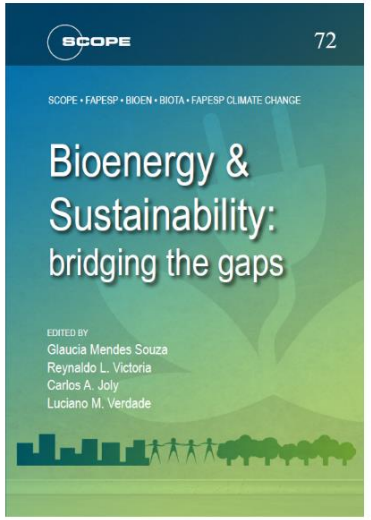
Review article

Sugarcane for bioenergy production: an assessment of yield and regulation of sucrose content

Alessandro J. Waclawovsky[1,†,‡], Paloma M. Sato[1,‡], Carolina G. Lembke[1], Paul H. Moore[2] and Glaucia M. Souza[1,*]

[1]*Departamento de Bioquímica, Instituto de Química, Av. Prof. Lineu Prestes, São Paulo, Brazil*
[2]*Hawaii Agriculture Research Center, Kunia, HI, USA*

Bioenergy & Sustainability: bridging the gaps



SCOPE Bioenergy & Sustainability is a collective effort with contributions from 137 researchers of 82 institutions in 24 countries.

The volume is the outcome of an assessment that included a meeting held at UNESCO, Paris, in December 2013. Fifty experts discussed bioenergy sustainability across its whole lifeline and crosscutting aspects including energy security, food security, environmental and climate security, sustainable development and innovation.

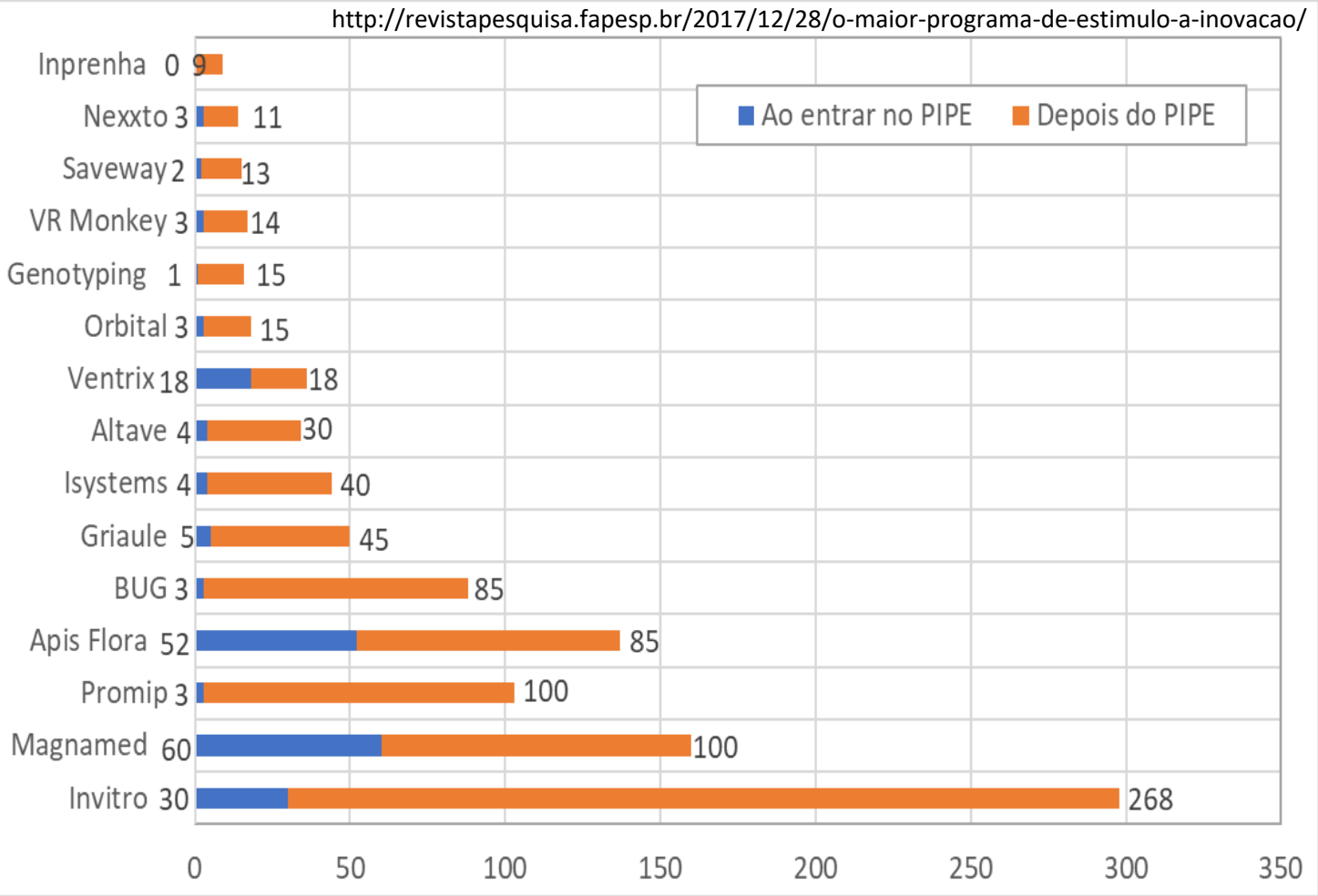
University of Campinas: 485 start-ups; 29 thousand jobs w. R$ 3 billions in revenues (2016)

2012-2016:

34 start-ups/year

FAPESP's Small Business Innovative Research Program: increase in highly qualified jobs

http://revistapesquisa.fapesp.br/2017/12/28/o-maior-programa-de-estimulo-a-inovacao/



Remarkable impact in the number of jobs:

- + 40% in jobs total
- + 30% in direct contracts
  - + 60% in personnel with higher education
  - >= 90% for personnel with graduate level

Griaule: internationally competitive biometry technology

EXAME

PME

Empresa de Campinas ganha licitação de US$ 75 milhões do Pentágono

A brasileira Griaule vai fornecer o sistema de certificação dos dados biométricos de 55 milhões de cidadãos no Iraque e 30 milhões no Afeganistão.

Por **Mariana Desidério**

8 nov 2018, 14h42 - Publicado em 7 nov 2018, 08h04

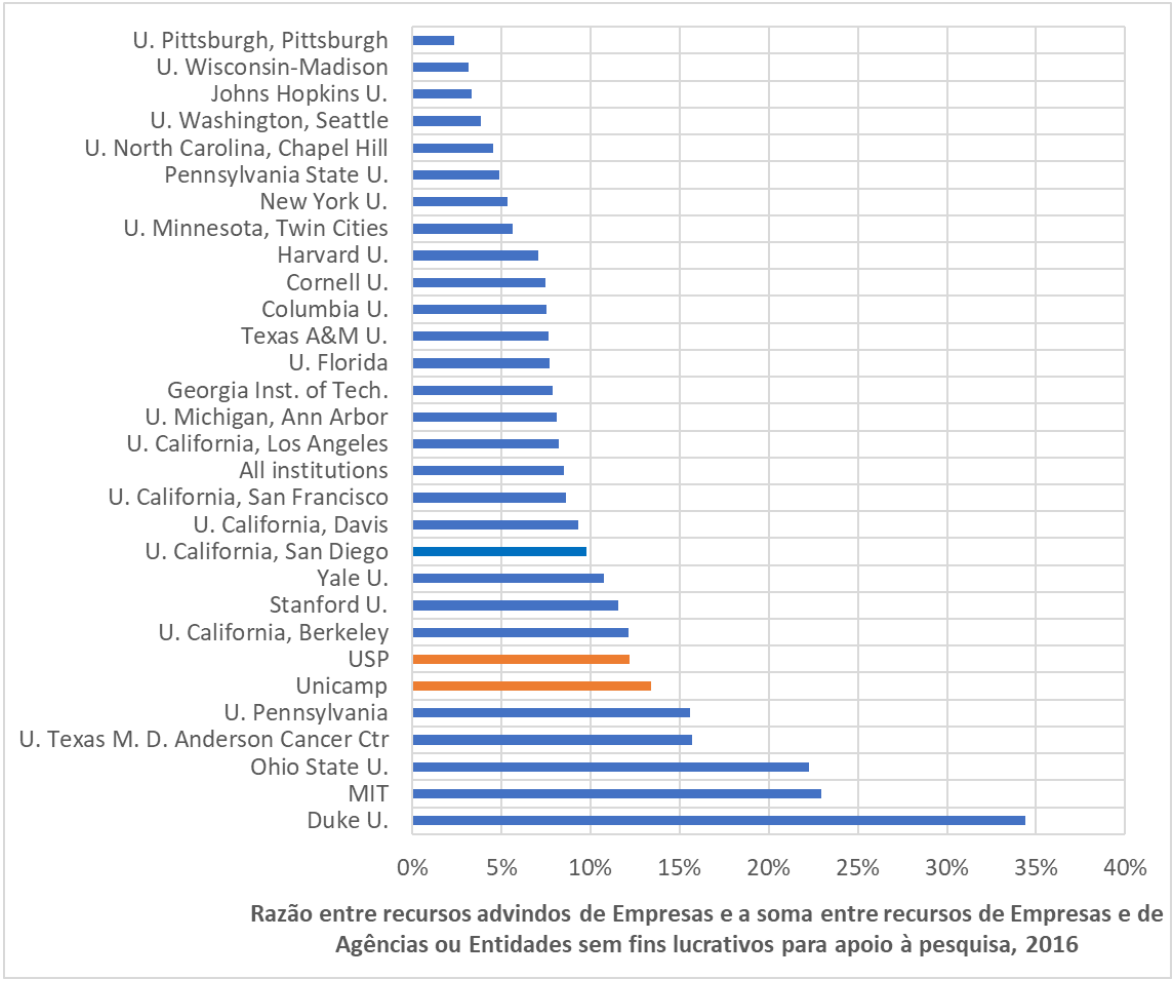
Centers Programs at FAPESP: Advancement of Knowledge and Industry Collaboration

- A long-term plan for Advanced Research
- Center is hosted in a university/institute,
- Center Director is a professor/researcher
  - Adjunct Director is a researcher from the company as a visiting professor at the university
  - Other company researchers participate as visiting professors
- 10-years contract
- Cost sharing: FAPESP: Industry: University ~ 1:1:2
  - US$ 0.5 – 4 million per year from FAPESP and Company, plus labor and infrastructure costs by university

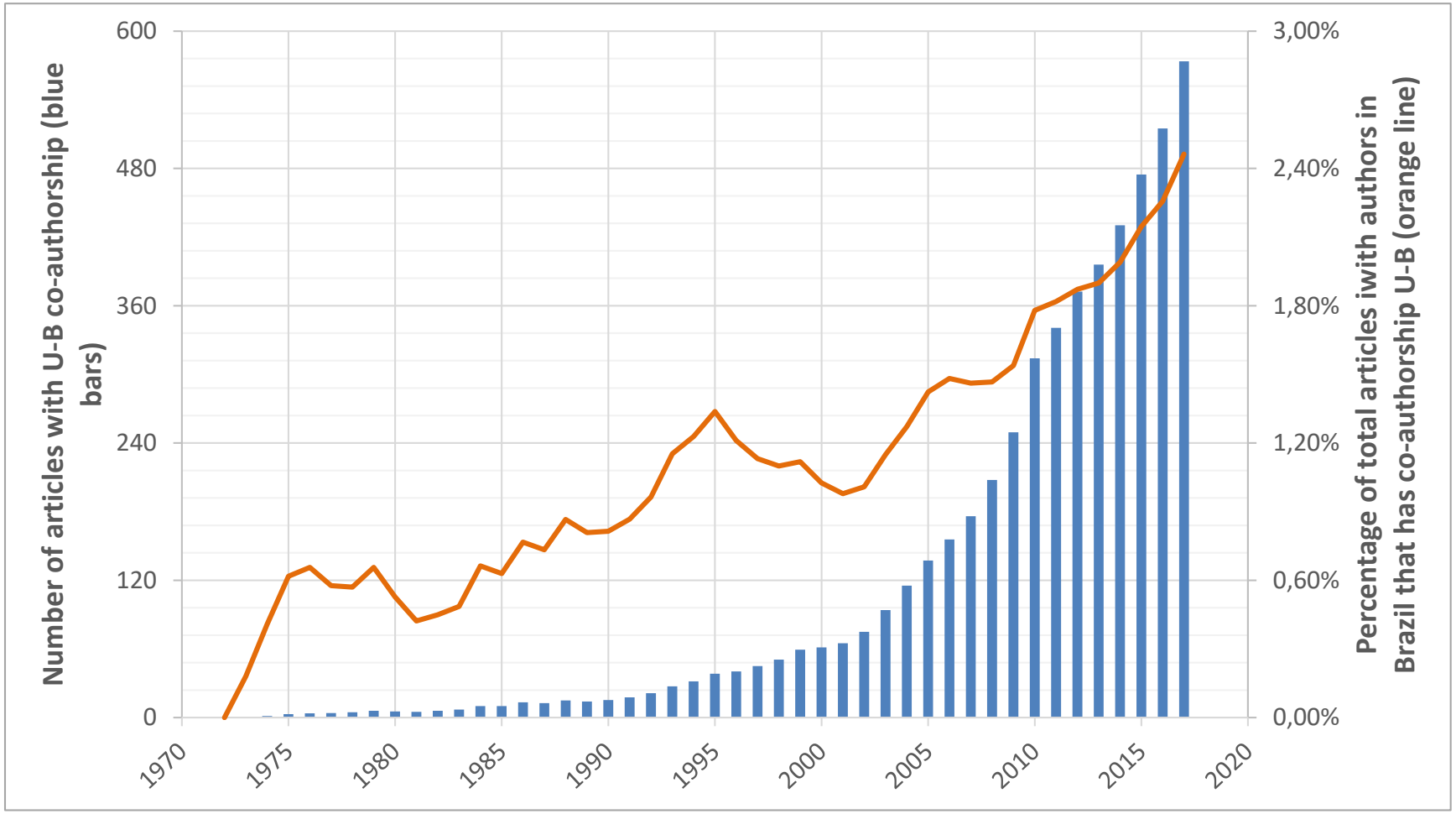
Engineering Research Centers: R$ 1,01 bilhões in contracts; FAPESP+Business+Univ./Inst.

Centro	Empresa/ Univ /Inst. Pq.	FAPESP (est 10 anos)	Empresa (est 10 anos)	Instituição (est 10 anos)
Biofuel automobile engines	Peugeot-Citroen Unicamp e outras	R$ 11 M	R$ 8 M	R$ 15 M
Green Chemistry	GSK Ufscar e outras	R$ 12 M	R$ 57M	R$ 42M
Target discovery	GSK Inst. Butantan	R$ 26 M	R$ 23M	R$ 67M
Natural Gas	Shell/BG Poli, USP e outras	R$ 46 M	R$ 58M	R$ 42M
Human well-being	Natura Inst. Psicologia, USP+	R$ 9 M	R$ 10M	R$ 22M
Agriculture, Climate Change, and Gene Editing	EMBRAPA Unicamp	R$ 25 M	R$ 33M	R$ 45M
New Energy (1 hub, 4 spokes)	Shell/BG Unicamp, IPEN, USP-SC	R$ 42 M	R$ 65 M	R$ 158 M
Oil and Gas Reservoirs	Equinor (Statoil) Unicamp	R$ 34 M	R$ 26 M	R$ 125 M

Business funding for university research



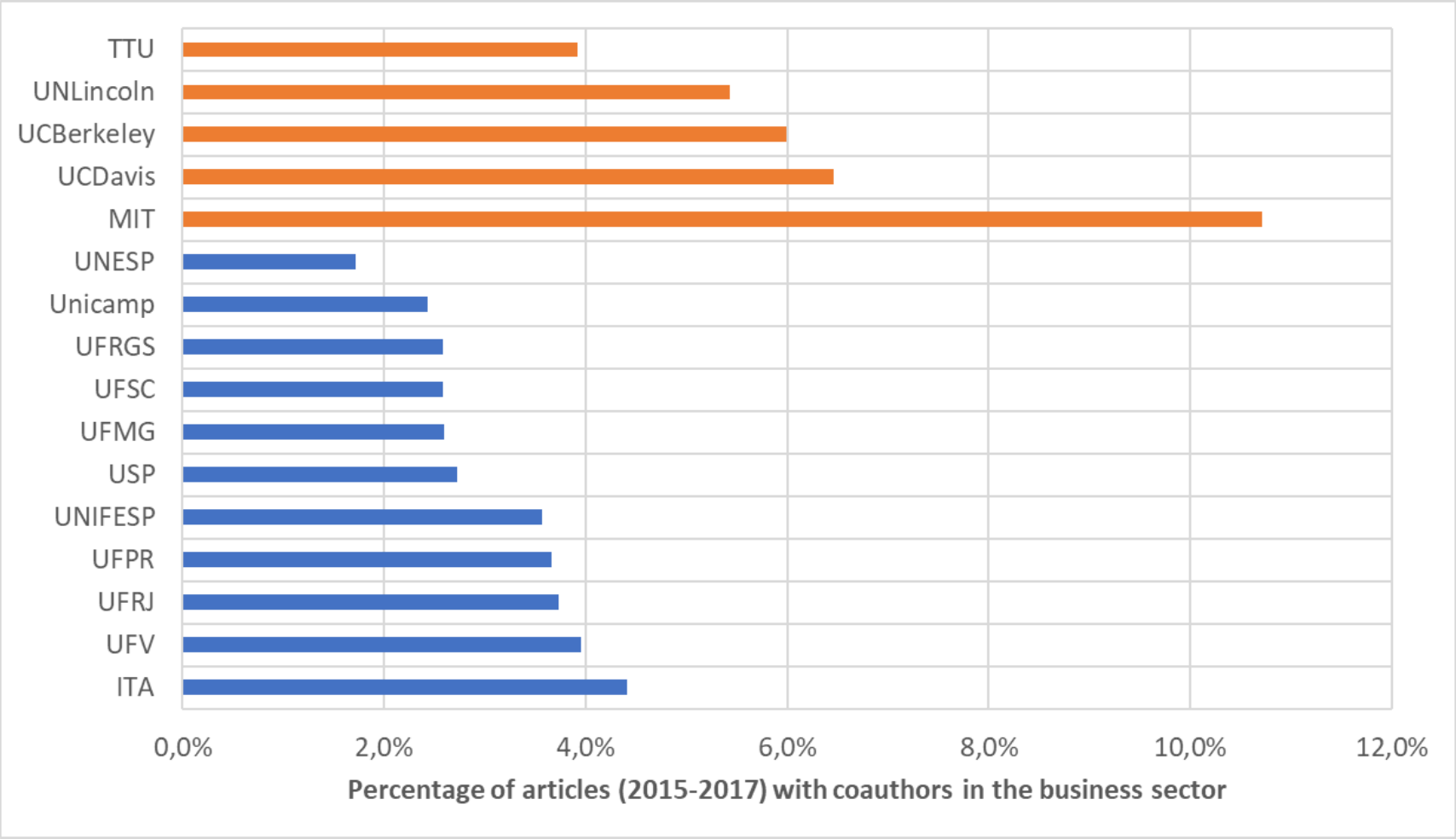
Collaboration: University-Business research collaboration in the state of São Paulo, Brazil



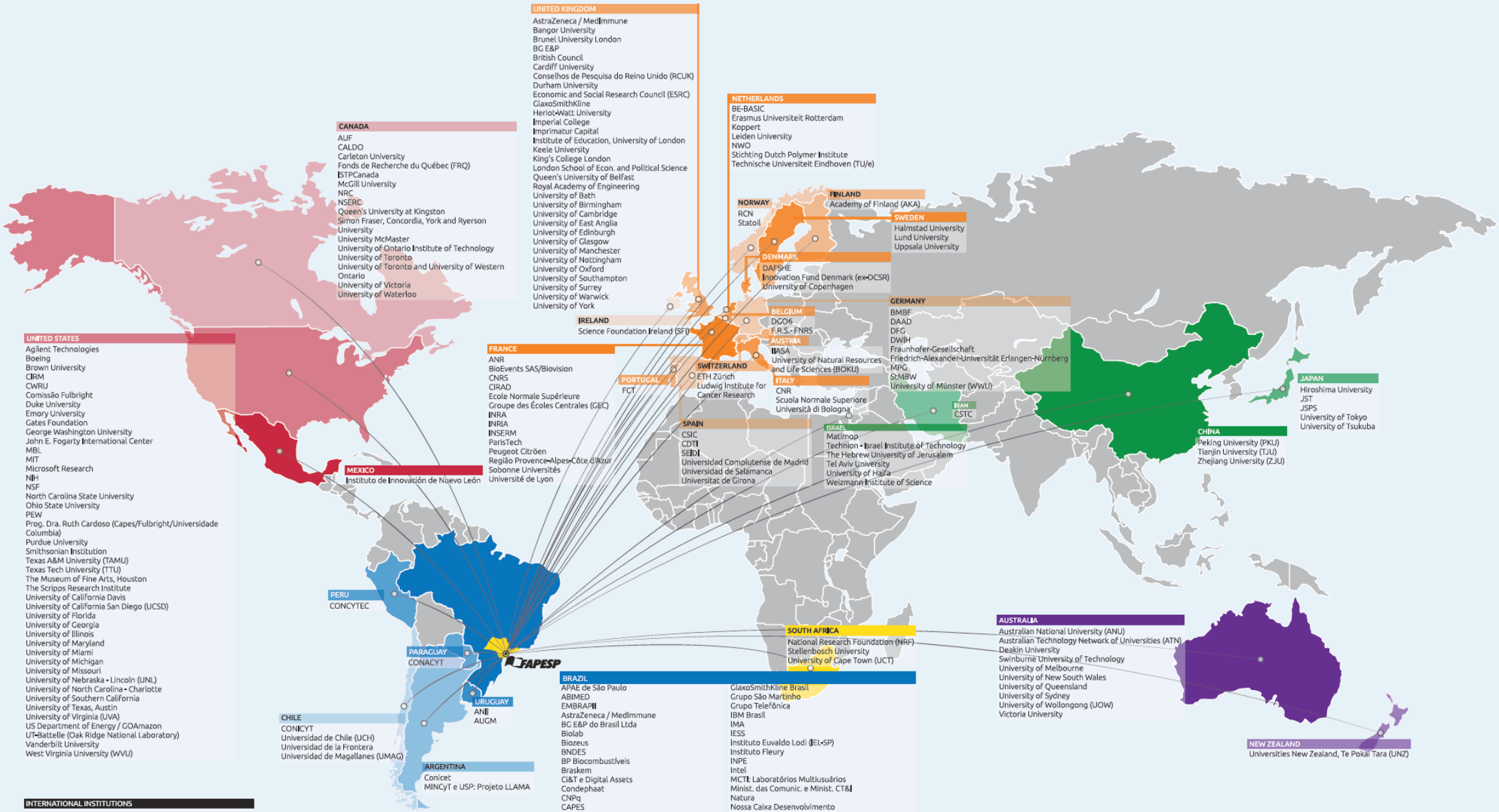
Main partners

- Petrobras
- Novartis
- Pfizer
- Roche
- GSK
- IBM
- Vale/ITV
- Merck
- Eletrobras
- AstraZeneca
- Fibria
- Westat
- Janssen
- Embraer
- Bayer
- Monsanto
- Agilent
- Braskem
- Boehringer Ingelheim
- Sanofi

University-Business co-authorship in scientific articles



INTERNATIONAL RESEARCH COLLABORATION



2018, FEBRUARY

FAPESP: International research collaboration

- Vision
  - Make the State of São Paulo an internationally recognized research hub
- Collaboration entails sending and receiving scientists
  - There is internationally competitive research in São Paulo that attracts qualified foreign researchers
- Collaboration is much more than researcher mobility
  - FAPESP targets full research projects, with multi-year duration, conceived, written, presented and developed together
  - Complex objectives, international competitivity

FAPESP: International Research Collaboration

- Joint funding agreements
  - Research Funding Agencies/Associations
    - Full projects, up to 10 years duration
  - Universities
    - Mobility of Pis (always) and students (sometimes) aiming at preparing joint proposals
- Unilateral FAPESP initiatives
  - All grants have funds for inviting foreign researchers
  - Visiting Researcher Grant
  - Scholarships Abroad for São Paulo based researchers, BPE
  - Scholarship for International Research Visits, BEPE (up to one year)
  - São Paulo Schools of Advanced Science (SPSAS)
  - FAPESP Week
  - São Paulo Excellence Chair, SPEC
  - Astronomy, LHC, Neutrinos, Bioenergy, Climate Change

FAPESP International Research Collaboration: bringing foreign scientists to SP

- Post doctoral fellowships (671 new awards in 2015)
  - Stipend, travel, some research money
- Young Investigator Awards (60 new awards in 2015)
  - Stipend, travel, full research support in a 4-year grant
- Visiting scientists
  - 275 in 2010 (travel, stipend; 2 weeks to 12 months)
- São Paulo Schools of Advanced Science (SPSAS)
  - Each one brings 50-100 young Dr students from abroad
- São Paulo Excellence Chairs (SPEC)
  - For senior level scientists from abroad: full research grant for staying 12 weeks per year in SP for 3-5 years

Opportunities for foreign scientists in SP: Young Investigator Awards

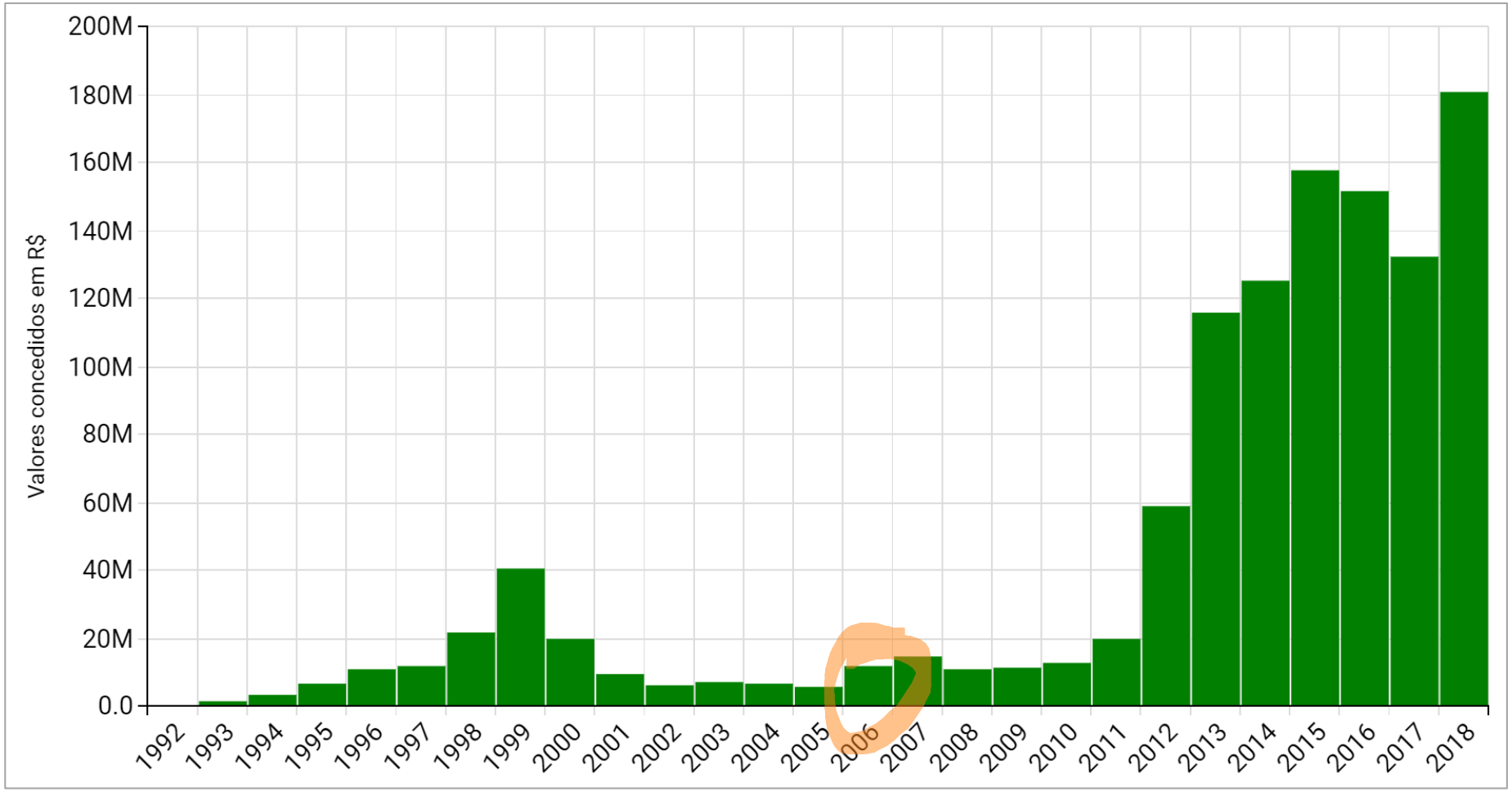
- Targets researchers with 2-5 years post-doctoral experience outside Brazil
  - Open to Brazilians and non-Brazilians
- 4-years grant, extendable for 1-year
  - Typical value ranges from US$ 200 th to US$ 2 million
    - Fellowship for PI (including travel and installation)
    - Equipments
    - Consummables
    - Travel
    - Fellowships for students
- 6,647 proposals, 1,542 awards since 1997
  - 507p/52a in 2017 (1 award every week)
- Info at http://www.fapesp.br/en/4479

- **Starting 2018: Young Investigator Award II → 5 years more for outstanding YI in YIA I**

FAPESP: value awarded to grants with (true) international research collaboration

- Agreements with Funding Agencies and Universities
- Projects are conceived jointly
- Peer review selection
- Proposals compete with all other proposals on the table (no set-asides)

- Plus unilateral FAPESP schemes: visitors, students abroad; Young Investigators



São Paulo: % articles with international co-authors

São Paulo: % articles with international co-authors

FAPESP Week: display S&T in São Paulo and collaborations

R&D in the State of São Paulo, Brazil Conclusion

- 70,000 researchers
- Strong efforts in Academia and in Business
- A strong base in basic science and graduate schools
- Growing portfolio of applied research
- Collaboration:
  - Geographic dimension: International and regional agreements
  - Institutional dimension: university-business joint research

To know about research in São Paulo: FAPESP Newsletter – in English

http://agencia.fapesp.br/en/

Three dimensions for impact

- Social impact
  - Ideas that increase well being, assist or inform public policy, increase the benefit from public goods
- Economic impact
  - Ideas that lead to new businesses
  - Ideas that increase economic competitiveness
  - Ideas that originate new industry sectors
- Intellectual impact
  - Ideas that originate more ideas
  - Ideas that make humankind wiser
  - Ideas strongly cited in the literature