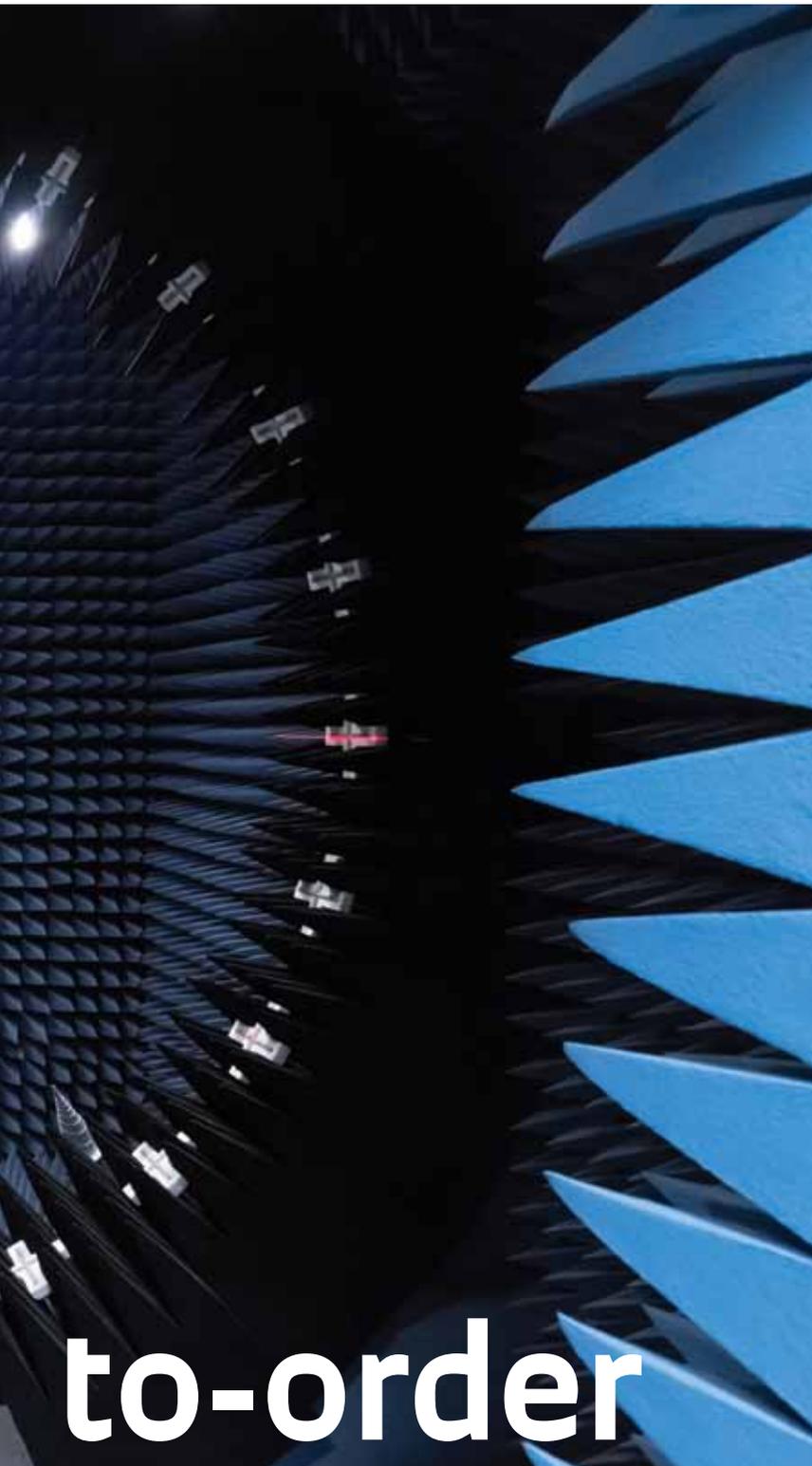


Challenges made-

Eighteen São Paulo private institutes conduct research in response to demands in health, technology, agriculture, and the social sciences

Fabício Marques and Bruno de Pierro | PUBLISHED IN OCTOBER 2016



to-order

ELDORADO INSTITUTE

Lab at the Eldorado Research Institute: investment in validation of wireless transmission systems

The most notable facet of science and technology in Brazil is usually associated with the work that has been produced by public universities and institutions, as well as with innovations that have been generated by companies. However, there is a much lesser-known type of organization, which has recently emerged and has also been making contributions: private institutes, usually nonprofits, which have been filling research orders for companies and government agencies. There are 18 of these institutes in the state of São Paulo, according to a survey that was published in the *FAPESP 2015 Annual Activity Report*, which is available at www.fapesp.br/en/publications/2015_report.pdf. Some of these institutes are affiliated with private hospitals that seek to transfer the results of clinical research to the treatment of patients. Others are centers for research and development (R&D) that focus on challenges in areas such as information technology, telecommunications, and agronomy.

One of the oldest private institutes, which has the broadest products and services portfolios, is the Center for Research and Development in Telecommunications (CPqD). Formerly a research center for the state-owned Telebras, it became a private nonprofit foundation 18 years ago, after the privatization of the telecommunications industry. Its 1,100 employees work on projects in fields such as communications, computer science, national defense, data networks and security, and have been commissioned by companies to take use the available resources from the Information Technology Act, the Fund for Technological Development of Telecommunications (Funttel), the National Science and Technology Development Fund (FNDCT), and the Brazilian Development Bank's Technological Fund (Funtec). The CPqD also conducts projects in partnership with the Brazilian Industrial Research and Innovation Corporation (Embrapii) and provides consulting services to companies.

The CPqD engages in cutting-edge research. Recently, a group that was coordinated by electrical engineer Jacklyn Dias Reis, of the CPqD, set a new record for fiber-optic distance and data transmission rate. Using 10 channels on the same fiber, each with a 400 gigabits-per-second (Gbps) traffic capacity, the team was able to send an enormous amount of data along 370 kilometers (km) of optical fiber to reach its destination without errors (see *Pesquisa FAPESP* Issue No. 246). A unique feature of the CPqD is that some projects eventually become startup companies. A recent case is BrPhotonics, a firm that was established in 2014 and focuses on the development of high-speed

Profile of the Institutions

The 18 private research institutions in São Paulo

Foundation CPqD Center for Research and Development in Telecommunications

Headquarters: Campinas;
Started: 1976

Areas: solutions in information technology and communications, technology services

Eldorado Research Institute

Headquarters: Campinas;
Started: 1999

Areas: software, hardware, systems, trials and tests of electronic products

Flextronics Institute of Technology – FIT

Headquarters: Sorocaba;
Started: 2003

Areas: software, hardware, testing

Venturus Innovation and Technology

Headquarters: Campinas;
Started: 1995

Areas: software, telecommunications, digital TV

FITec Technological Innovations

Headquarters: Campinas;
Started: 1997

Areas: software, electronic equipment, telecommunications

Wernher von Braun Center for Advanced Research

Headquarters: Campinas;
Started: 1997

Areas: semiconductors, software, electronic products

Sugarcane Technology Center

Headquarters: Piracicaba;
Started: 1969

Areas: genetic improvement of sugarcane, energy production

Citriculture Defense Fund (Fundecitrus)

Headquarters: Araraquara;
Started: 1977

Areas: diseases affecting citrus

Brazilian Center for Analysis and Planning (CEBRAP)

Headquarters: São Paulo;
Started: 1969

Areas: social sciences, philosophy, literary and artistic criticism, public policy

A.C. Camargo Cancer Center

Headquarters: São Paulo;
Started: 1983

Areas: oncology, translational medicine, genetics

Albert Einstein Israeli Institute of Education and Research

Headquarters: São Paulo;
Started: 1998

Areas: aging, welfare, cardiology, neurology, hospital management

Syrian-Lebanese Institute of Education and Research

Headquarters: São Paulo;
Started: 2003

Areas: obesity, diabetes, oncology, physical therapy

Pius XII Foundation/Cancer Hospital of Barretos

Headquarters: Barretos;
Started: 2003

Area: oncology

Dr. Domingos A. Boldrini Pediatric Center for Hematological Investigation

Headquarters: Campinas;
Started: 1986

Areas: oncology, pediatric oncology, diagnostics

Institute of Health Education and Sciences of the Oswaldo Cruz German Hospital

Headquarters: São Paulo;
Started: 2007

Areas: bariatric and metabolic surgery, obesity, diabetes, endocrinology, oncology, pain

Beneficência Portuguesa Hospital

Headquarters: São Paulo;
Started: 2008

Areas: oncology, cardiology, nephrology

Santa Casa Research Institute of São Paulo

Headquarters: São Paulo;
Started: 1963

Areas: orthopedy, ophthalmology, pediatrics

Research Institute of the Hospital do Coração

Headquarters: São Paulo;
Started: 2007

Areas: cardiology

optical communications (see *Pesquisa FAPESP* Issue No. 238). Even before that, other companies had emerged out from the CPqD. As was the case with Padtec, which was established as a component company in 1999 and was privatized in 2001 (see *Pesquisa FAPESP* Issue No. 219). “Not only are we transferring knowledge to the general public, but members of our team usually end up moving into startups,” says Alberto Paradisi, innovation vice president at the CPqD, who emphasizes that the infant companies have also become partners with the foundation—both BrPhotonics and Padtec work with the institute on optical communications projects that have been commissioned by private companies and by the government.

The Eldorado Research Institute, located adjacent to the University of Campinas (Unicamp) campus, was founded by Motorola in 1999 as a nonprofit entity. In its early years, it worked almost exclusively for that American company, using funds that were available under the Information Technology Act. In 2009, it experienced an abrupt change when Motorola eliminated two-thirds of the projects that it had been sponsoring at Eldorado. The company was sold the following year. “It was a tough time; we had practically no income and were going into debt to build our headquarters,” recalls Jaylton Ferreira, Eldorado Institute superintendent. “The solution was taking an aggressive stance and offering services to other companies.”

Today, the Eldorado model is quite different. In 2015, the Institute conducted approximately 140 research projects, involving more than 60 different companies, including Dell, Samsung, and IBM, as well as Motorola. Current projects use funds from sources such as the Technology Fund of the Brazilian Development Bank (BNDES), as well as partnerships with Embrapii. The team of approximately 800 employees and researchers works at its facilities in Campinas, Brasília, and Porto Alegre, where it is developing new technologies and adapting existing ones for cellphones, tablets, and other devices, as well as conducting tests with the equipment to determine whether the items comply with Brazilian standards. Some of the funds are dedicated to research in fields that have potential for innovation, such as the Internet of Things (which connects home appliances and cars to the web), virtual reality, and assistive technology.

Institutes such as the CPqD and Eldorado are devoted to both research and development; however, most centers, especially those that are connected to the cellphone industry, concentrate solely on the developmental aspects, particularly application software. Laws and public policies that encourage companies to invest in R&D support the work of a major part of these institutes.



Research on the disease that is known as *greening* is performed at the Fundecitrus lab in Araraquara, and a variety of sugarcane is being developed by the CTC in Piracicaba



The primary example is the Information Technology Act, which dates from the early 1990s. It granted tax incentives in the form of a reduction in the Federal Value-Added Tax (IPI) to companies that applied some of their sales revenues to research. When the law first took effect, most companies used the funds to support partnerships with universities. Later, large corporations established centers—usually nonprofit foundations—to have more flexibility in allocating their financial resources.

This was the case, for example, with Alcatel Lucent, which established the FITec, which is an institute with facilities in Campinas, São José dos Campos, Recife, and Belo Horizonte, and Venturus Innovation and Technology, which was founded in 1995 by a consortium that was led by Ericsson. “People who say that the Information Technology Act has not created jobs or encouraged technology in Brazil don’t know what they are talking about. An enormous volume of research was produced, thanks to the law’s incentive,” says Marcelo Abreu, innovation and new businesses manager at Venturus. Headquartered in Campinas, the institute currently has 300 employees, and a significant part of its income comes from projects that are commissioned by companies that benefit from the Information Technology Act. It works for various clients, some of whom compete with each other, and it maintains separate offices and teams for each project to ensure confidentiality.

The main focus of Venturus is the development of applications for mobile phones. “We were responsible for developing cell phone applications for the last two Soccer World Cups that Sony Mobile offered to customers all over the world,” Abreu says. In a study that was published in 2010, Eva Stal, a professor at United Metropolitan Colleges in São Paulo, demonstrated that the institutes that have been created by the incentive provided by the Information Technology Act developed innovative capabilities that differed from the skills that usually result from collaborations between companies and universities. “By establishing these institutes, companies had an opportunity to decide what they were going to do, and they developed skills to meet the demands of manufacturers worldwide,” she wrote. The ability to come up with new solutions persists, observes Gedier Ribeiro, manager of new businesses at the FIT Technology Institute, which was founded in 2003 by the Singapore electronics manufacturer Flextronics. “When a company can’t find the solution it needs in the market, we create a customized technology. It might be robots for its production line, a set of software programs or artificial intelligence devices,” he explains. The institution, which is headquartered in the city of Sorocaba, has 260 employees. “Seventy percent of the projects are based on tax concessions. A lot of companies submit orders and pay with their own funds.”

Investment in research helps hospitals become world-class institutions, says Ana Maria Malik

The Brazilian private R&D institute model reminds us of the research and technology organizations (RTOs) that have been established in developing countries. These centers fulfill the role of generating and disseminating new technologies, financed by the government and private clients and through the provision of consulting services. This is the case, for example, of the German firm IABG, which was established by Germany in 1961 to develop technologies for the aerospace industry. It was privatized in 1993 and now works for the automotive and telecommunications industries.

An unique case among private institutes is the Wernher von Braun Center for Advanced Research in Campinas, which is a product of a single researcher's initiative - physicist Dario Sassi Thober. The original idea was to conduct pure research in physics with potential industrial applications. Over time, the nonprofit institution concentrated its efforts on developing software and semiconductors and on management systems that work with very high volumes of data. The center also designed an electronic toll collection system that is currently used on highways throughout Brazil. It is composed of a sticker containing a microchip, which is installed in cars. The chip communicates with detection devices placed in toll plazas and parking lots. "We set up a factory in Asia to make the semiconductors we developed, which reduced operating costs for the client," Thober recalls. He resents the loss of several talents who left the institute in 2015. "Some of them went to work for semiconductor companies in other countries, for salaries well above those paid in our market," he laments.

RESEARCH AT HOSPITALS

Another environment in which custom-ordered research has become more significant is the private health care sector. In 2015, the Sírio-Libanês Hospital (HSL) in São Paulo announced that it was conducting genetic testing in order to guide choices for the most effective treatments against cancer and to provide early detection of disease progression and the development of resistance to the drugs that are used for treatments (see *PES-QUISA FAPESP* Issue No. 237). The study, which

is coordinated by geneticist Anamaria Camargo, was conducted at the Syrian-Lebanese Institute of Education and Research (IEP), which a laboratory space of 1000 m². The IEP and other institutes that are affiliated with hospitals in the state of São Paulo follow a model that combines health care with education and research. The research is structured in two categories: clinical and experimental. The former investigates the effects of drugs and therapies tested on patients. These studies may be ordered and sponsored by pharmaceutical companies. In its experimental research, the IEP seeks ways to fight diseases or improve treatments, even if the results might initially have no practical application.

Ana Maria Malik, a physician and professor at the São Paulo School of Business Administration (FGV-SP), says that the strategy of investing in research helps hospitals to become centers of excellence. "They gain prominence, thus attracting qualified researchers that helps them upgrade their employees' overall skills," she explains. In 2008, researchers who were associated with the HSL published 38 articles in indexed journals. In 2016, that number increased to 170. "A percentage of those studies started out as clinical cases of hospitalized patients," reports Luiz Fernando Lima Reis, director of the IEP-HSL. In 2016, the HSL invested approximately R\$20 million in research. Half of this comes from the hospital's own budget and the remainder comes from contracts with industries, sponsored clinical trials, or technology validation projects. The amount that is received from agencies such as FAPESP and the National Council for Scientific and Technological Development (CNPq) represents R\$1 million. Another R\$1 million comes from donations.

Epidemiological research, mainly in cardiology and nephrology, as well as clinical studies that are financed by the pharmaceutical industry are conducted at the research center that is operated

Installation of a system for detecting cars at toll plazas that was developed by the Von Braun Center: every car bears a label with a chip





Laboratory at the A.C. Camargo Cancer Center: 159 oncology research projects were completed in 2015

by the Beneficência Portuguesa Hospital of São Paulo. Follow-up assessments of cardiology patients who have undergone revascularization surgery or angioplasty date from 2009. In the past three years, more than 107 scientific articles have been published. Many of these discuss patients who are being monitored by the hospital. “We are looking for new ways to encourage research,” says Luiz Eduardo Bettarello, executive superintendent of Technical Development at the Beneficência Portuguesa Hospital of São Paulo. Meanwhile, at the Institute of Education and Health Sciences at the Oswaldo Cruz German Hospital, most of the research funding is obtained through partnerships with companies, observes neurologist Jefferson Gomes Fernandes, its superintendent of Education and Sciences. “The institute has been conducting clinical research with participation of physicians from its clinical staff,” he says.

Some hospitals have tax incentives that are available for use in research. “In Brazil, world-class hospitals are encouraged by the government to conduct studies that could yield results and assist the public health network,” explains Ana Maria Malik of FGV-SP. Currently, six hospitals fit that category: in São Paulo, the Sírio-Libanês, the Albert Einstein, the Hospital do Coração (HCor), the Samaritano, and the Oswaldo Cruz; and in Rio Grande do Sul, the Hospital Moínhos de Vento. All of these hospitals participate in the Program to Support the Institutional Development of the Unified Health System (SUS),

Some institutions receive incentives to conduct studies that interest the Unified Health System (SUS)

the Proadi-SUS, and they can obtain income tax deductions from sums that are allocated to research projects which have been approved by the Ministry of Health. In the case of the Hospital Oswaldo Cruz, 16 projects that were completed between 2012 and 2014 were financed by a waiver of approximately R\$105 million in taxes.

At the Albert Einstein Israeli Hospital, custom-ordered research represents 5% of the projects that it develops. “Most of our research is sparked by questions asked by physicians,” reports Luiz Rizzo, executive director of research at the Albert Einstein Israeli Institute of Education and Research. Presently, the hospital has 15,000 employees, 700 of whom are involved in scientific activities. In all, there are 459 projects in progress. Today, the principal line of research addresses issues that pertain to aging. The hospital’s budget for research is R\$23 million per year. In addition to that sum, the hospital obtained more than R\$5 million in 2016 from participation in proposals programs that were issued by agencies such as FAPESP and CNPq and partnerships with foreign researchers on projects that are supported by international organizations such as the National Institutes of Health (NIH) in the United States.

Among the hospitals that are conducting research in São Paulo, some stand out because of their traditional specialties. This is true of the A.C. Camargo Cancer Center, which is one of Brazil’s leading centers for research and specialized care in oncology. In 2015, the hospital performed 35 million treatments, 62% of which were covered by SUS. Approximately 90 professionals are engaged in scientific work, not counting members of the clinical and caregiver corps who also conduct projects in collaboration with the Research Center. The center occupies a building in the Liberdade district of the city of São Paulo, and it was inaugurated in 2010 during the administration of oncologist Ricardo Renzo Brentani. As CEO of FAPESP from 2004 through 2011, Brentani presided over the Antônio Prudente Foundation, which maintains the A.C. Camargo, and in 1997, it was responsible for launching the first graduate course ever given at a private hospital in Brazil. “Professor Brentani showed the clinical corps that it is important to conduct researches, not only because it makes a difference in one’s career but because it is essential for fighting cancer,” recalls Vilma Regina Martins, of Research and Edu-

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National reference in public policy

CEBRAP is supported by funds from private sources and government agencies

The Brazilian Center for Analysis and Planning (CEBRAP), a research institute that is dedicated to the social sciences and humanities, was founded in the late 1960s under the leadership of a group of intellectuals and professors who had been forced by the dictatorship to retire. Among them were the sociologist and future President of Brazil, Fernando Henrique Cardoso, and philosopher José Arthur Giannotti. Financed primarily by foundations that were based abroad, such as the Ford and MacArthur foundations, in its first 15 years CEBRAP devoted its work to studies in which it became a leading authority in health, demographics, and urban development. After re-democratization, the flow of foreign funds diminished and put the model at risk of extinction. "Several institutes with the same background ended up closing, but we were able to adapt," says sociologist Angela Alonso, a professor at the School of Philosophy, Literature and Human Sciences of the University of São Paulo (USP) and current president of the center.

However, changes had to be made in the organizational structure. CEBRAP encouraged its researchers, of whom it now has 38 who are permanent, along with more than 100 associates, to apply for positions at public universities through competitive exams and stopped paying them salaries—thus, those who teach at the public universities became volunteers at CEBRAP. The resources that are obtained from funding agencies and government organizations pay for major projects, such as the



CEBRAP staff head up initiatives such as the Center for Metropolitan Studies

Center for Metropolitan Studies, which is one of FAPESP's Research, Innovation and Dissemination Centers (RIDCs), as well as participation in the Brazilian Platform on Drug Policy and evaluations of public policies on behalf of city governments.

CEBRAP is also called upon to conduct projects that have been commissioned by private institutions. One of its current clients is Banco Itaú, which asked CEBRAP to study sites in which bicycle rental services could be established in major Brazilian metropolitan areas. Public and private financing has kept research alive within CEBRAP; however, it stills encounters obstacles.

The inability to use research project funds to cover its administrative overhead means that the center would find it difficult, for example, to do a simple project on accessibility at its headquarters. A fundraising campaign that is directed toward seeking donations from businessmen and alumni (www.cebrap.org.br/endowment) is being launched to help finance fixed expenses that are unrelated to research.

cation superintendent at the A.C. Camargo Cancer Center. In 2015, 159 projects were conducted and 168 articles were published in international periodicals, addressing subjects such as the diagnosis and treatment of cancer, tumor biology, and palliative care.

The Boldrini Pediatric Center, which is located in Campinas, is also dedicated to cancer research. Built as the result of donations, the philanthropic hospital was established in 1978 and began to specialize in the treatment of cancer and blood disease in children and adolescents. It currently serves approximately 6,000 patients—most of them (80%) covered by the SUS. Because of its work with clinical research, since 1980s, the center has been known for coordinating a number of Brazilian protocols for the treatment of acute lymphoid leukemia in children, which has helped to increase curability chances from 5% to 80%. "With those cooperative studies, with several Brazilian hospitals working together, the Boldrini was able to implement sophisticated technologies in its examinations, molecular biology techniques and cytogenetics," says physician Silvia Brandalise, executive director of the center, which in 2017 will inaugurate its Institute of Molecular and Cellular Engineering on a 4,000 m² site in Campinas. The center is the result of a partnership with Unicamp and the National Synchrotron Light Laboratory (LNLS).

AGRIBUSINESS

Applied research in agribusiness has revitalized two traditional private research institutes. One is the Sugarcane Technology Center (CTC), which was founded in 1969. The CTC became a corporation in 2011 with the Raízen and Copersucar companies as principal shareholders. It then began to search for new sources of financing to stimulate its research in sugarcane. An industry report that was published at the time showed that, although sugarcane productivity had increased in recent decades, there were bottlenecks that hindered significant gains in productivity. "Defining a focus and boosting investments in research is essential in order to expand productivity. The model we adopted seemed to be the most suitable for responding to that challenge, since it enables us to forge strategic alliances with other groups," says Gustavo Teixeira Leite, CTC president. "Sugarcane is very complex genetically: this makes research more complicated, expensive, and time-consuming. It means that multinationals are less interested in investing in it," says Leite, a former president of the multinational Monsanto in Brazil.

Equipment is shared by researchers, physicians and graduate students at the Albert Einstein Israeli Hospital in São Paulo



Between now and 2025, the CTC's goal is to introduce technologies that will enable sugarcane productivity to double - its current productivity is approximately 10 tons of sugar per hectare. For this to happen, the previous sum of approximately R\$50 million, which had been invested annually has increased to R\$200 million per year. To set the plan in motion, the center sold 19% of its stock to the BNDES for R\$300 million, and it obtained credit lines from the same bank, as well as from the Brazilian Innovation Agency (FINEP). The CTC also changed its business model: it now sells technology to clients and collects royalties. Its team of 450 employees, 300 of whom work in research, is investing funds on several fronts. The number of genetic improvement programs has risen from one to six in order to create sugarcane varieties that meet the needs of the six Brazilian regions in which the crop is produced. "The time it takes to obtain a new variety, which used to be 15 years, has decreased to 8 years." Another important program will focus on the development of artificial seeds. "Sugarcane is planted much in the same way it used to be when Brazil was colonized: we use cuttings. We place them in furrows and wait for them to grow. Our idea is to produce seeds from the plant's embryo and sow them like we would grain, something that hasn't been done anywhere in the world," he says.

While the CTC decided to become a corporation, another institution that is devoted to agricultural research, the Citriculture Defense Fund (Fundecitrus), operates as a nonprofit private association that is supported by citrus growers and the orange juice industry. Founded in 1977,

The Sugarcane Technology Center quadrupled its budget to increase productivity

Fundecitrus now invests R\$23 million annually in research for the control of agricultural pests. A team of 15 researchers works at four laboratories in the city of Araraquara and at 65 experimental fields in three different states. In the 1990s, when Citrus Variegated Chlorosis (CVC), a pathogen that is known as *amarelinho*, or "yellowing," became more severe, Fundecitrus established its Scientific Department, which inherited the objectives of Procitrus, a private foundation similar to Fundecitrus. The effort at the time was devoted to the surveillance and eradication of diseased plants. "We eventually had 4,000 inspectors traveling in one thousand vehicles to carry out inspections and enforce control. Now we have become an intelligence center," says Juliano Ayres, manager of Fundecitrus.

The fund's effort, which works with universities, companies, and Embrapa (Brazilian Agricultural Research Corporation), has made it possible to reduce the incidence of CVC, which had a 50% incidence in plants in 1990, to a 3% incidence this year. Progress has occurred because of a set of research projects that attempted to understand the mechanisms by which the pest works and to control it. The causative agent, the *Xylella fastidiosa* bacteria, was the subject of the world's first genetic sequencing of a pathogen, which was made possible with funding from FAPESP and a contribution from Fundecitrus. "No other citriculture industry in the world has research programs like ours. Today, the main threat, a disease known as *greening*, is affecting 18% of our orange groves, while in Florida, that incidence has been as high as 80%," Ayres observes. ■