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LETTER FROM THE EDITOR

The sustainable future

Mariluce Moura
EDITOR IN CHIEF

The cover story for this second 2013 international issue of the magazine *Pesquisa FAPESP* reports on the wide variety of sugarcane studies that are currently being carried out by researchers from institutions in the state of São Paulo. Special emphasis is given to genetic research on bagasse and to investigations into the enzymes that are capable of boosting the hydrolysis of bagasse. As technology editor Marcos de Oliveira reports in an article beginning on page 5, the ultimate goal of these efforts is to produce more ethanol per hectare of land. Although this biofuel is quite clean compared to petroleum and comes from a renewable source, it still needs to be made more economically viable. With its long and successful tradition of research on sugarcane, Brazil can make a significant contribution to the development of second-generation ethanol.

In the first generation of production, sugarcane broth is converted by fermentation into biofuel. In the second generation, powerful enzymes break down the molecules of the bagasse and sugarcane leaves, allowing hydrolysis to extract additional sugar from the biomass. Genetics has been and remains a vital tool for advancing these protocols, and the launching in 1999 of the Sugarcane Genome Project (which was financed by FAPESP) was a decisive first step toward a more complete understanding of the important genes in sugarcane. New findings are now likely to encourage the use of hydrolysis and lead to an estimated increase of at least five billion liters in the ethanol production of Brazil, which is currently running at approximately 25 billion liters per year. Brazil is not alone in this race. In the United States, England, and Sweden, many laboratories are pursuing the same objectives, engaged in a scientific competition in which the big winner will be the environment.

We would also like to highlight from this issue a new study on Chagas disease that was conducted by researchers from the University of São Paulo (USP) and the Federal University of São Paulo (Unifesp). Since the discovery in 1909 of the disease and its causative agent, *Trypanosoma cruzi*, by the physician and scientist Carlos Chagas, unceasing efforts have been made to understand the mechanisms by which that parasite acts on the human body, as well as ways to prevent it. As the report by special editor Carlos Fioravanti (*page 34*) describes, the route that *T. cruzi* uses to

take up residence in a single cell and to differentiate, divide, and invade other cells has now been mapped out. This discovery opens up possibilities for developing new ways to combat and diagnose tropical diseases. Furthermore, these diseases have now also been observed in countries within temperate regions. Medical authorities in the United States, for example, have warned of the rise of Chagas disease in their region, especially among immigrants in states that are situated along the border with Mexico.

In the section on Technology, the example set by Embraer, the third largest manufacturer of jet planes worldwide—behind Boeing (United States) and Airbus (European Union)—provides evidence that companies should leave the confines of the research and development center and pursue partners in other places to add value to the manufactured product. Embraer has forged partnerships with universities, research institutes, and other companies in the aviation industry to develop new technologies for manufacturing composite materials, metallic structures, and on-board systems. One of the projects under way is examining biofuels based on sugarcane ethanol. This work is being carried out in cooperation with Boeing and a number of São Paulo research institutions, and it has received funding from FAPESP.

R&D Investment

Expenditures in research and development using state resources (DEPD) and Gross Domestic Product (GDP)

STATES	DEPD 2010 (in millions of US$)*	GDP 2008 (in billions of US$)**	DEPD (en %)	GDP (en %)
Acre	2.1	2,888	0.1%	0.2%
Alagoas	5.5	8,359	0.1%	0.6%
Amapá	2.6	2,903	0.1%	0.2%
Amazonas	27.4	20,095	0.7%	1.5%
Bahía	72.5	52,149	1.7%	4.0%
Ceará	38.2	25,793	0.9%	2.0%
Distrito Federal	42.3	50,460	1.0%	3.9%
Espírito Santo	9.7	29,987	0.2%	2.3%
Goiás	13.9	32,306	0.3%	2.5%
Maranhão	9.9	16,518	0.2%	1.3%
Mato Grosso	20.3	22,756	0.5%	1.7%
Mato Grosso do Sul	7.1	14,225	0.2%	1.1%
Minas Gerais	128.8	121,254	3.1%	9.3%
Pará	12.8	25,115	0.3%	1.9%
Paraíba	19	11,028	0.5%	0.8%
Paraná	249	76,939	5.9%	5.9%
Pernambuco	35	30,232	0.8%	2.3%
Piauí	1.1	7,193	0.0%	0.6%
Río de Janeiro	294.5	147,288	7.0%	11.3%
Rio Grande do Norte	11.4	10,936	0.3%	0.8%
Rio Grande do Sul	55.9	85,621	1.3%	6.6%
Rondônia	0.1	7,677	0.0%	0.6%
Roraima	1	2,098	0.0%	0.2%
Santa Catarina	126.4	52,911	3.0%	4.1%
São Paulo	**3,019.3**	**430,478**	**71.6%**	**33.1%**
Sergipe	8	8,391	0.2%	0.6%
Tocantins	1,5	5,618	0.0%	0.4%
Total	**4,216.6**	**1,301,229**	**100%**	**100%**

* Exchange rate in December 2010
** Exchange rate in December 2008

Source: DEPD - Ministry of Science and Technology, S&T Indicators. http://www.mct.gov.br/index.php/content/view/317045Brasil_Dispendios_dos_governos_estaduais_em_pesquisa_e_desenvolvimento_P_D_por_execucao_segundo_regioes_e_unidades_da_federacao.html

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The three articles highlighted here represent research projects that were carried out in São Paulo and serve as examples of the importance of science and technology to this state. From the supplied chart, we can see that in 2010, São Paulo invested more than $3 billion, which represented 71.6% of expenditures by all Brazilian states on R&D. São Paulo, meanwhile, produced 33.1% of the GDP of Brazil in 2008, the equivalent of $430 billion.