

# The biggest and the best

## São Paulo

It is a cruel shock to the senses to arrive in São Paulo on a wet, dark night. All that can be seen is a spinning confusion of freeways, underpasses, missed turnoffs and high-speed drivers who overtake on the inside and cut in front of one with a little flourish. São Paulo is huge; ringed by factories and slums and dissected by an irrevocably polluted pair of rivers. With more than nine million inhabitants, it is the largest city in Latin America and the third largest in the world.

Surprisingly, dawn reveals that São Paulo is also beautiful. It is a hilly city with plenty of green spaces and views and the broken skyline of tower blocks is never monotonous. Out of town — at around the 20-kilometre mark — the city degenerates sharply into shacks and shabby shanty towns, home to five million of the poorest.

São Paulo is the capital of the richest state in Brazil. Its inhabitants add up to less than a quarter of the total population but they generate half the nation's GNP. This one state contains half of Brazil's top eight universities, and best of them all is the University of São Paulo (USP).

The university is a little out of town, scattered over a slope from the top of which São Paulo is seen spreading across the horizon. At the bottom of the hill is a clock tower and the other usual symbols

rector who shook up the university through insisting on increased emphasis on research.

When he took office, the university had few funds of its own and almost all the money for research, even down to journal subscriptions, came from grants. Now 20 per cent of the university's \$250 million-a-year income from São Paulo state goes on non-personnel costs — laboratories, computers, libraries and the like.

Goldemberg says that when he became rector he decided to "make great efforts to be in the vanguard. Since Brazil needs modern technology we have to put a lot of emphasis on research and high quality." He says he met resistance.

"How do you put pressure on people who all have tenure?" he asks rhetorically. "You use a complex system of incentives — access to money, and better libraries, better communications, computers, sending people abroad . . .". Goldemberg recounts his various temptations and sighs over those who were not ready for them.

"Some areas were not in a position to absorb money. They had no ideas, no contacts. I would tell people to make a list of everything they wanted, then they found they could not make a proper list, they were used to underdevelopment." "People thought I was a bit harsh", he says, "but after the event they thought it was not so bad and even approved of what I had done."

Goldemberg's successor, Roberto Leal Lobo, was chosen by election two weeks ago. As elsewhere, there was heated debate over how much say students and support staff should have in the new 'democratic' election. USP decided on a safe multi-stage election that left the final choice to the professors and, ultimately, the governor.

Lobo is a physicist and was previously vice-rector, but his election was not a foregone conclusion. Running against him were the Secretary of State for Science and Technology (page 371), and half a dozen other university professors. A key issue during the campaign was the university's links with industry. Some candidates were against expansion of industrial involvement, others wanted it to be given the highest priority. Lobo backed a middle way with, he says, "human resources as the first priority, with an overflow to industry. Otherwise we'll just become an industrial research institute."

'Evaluation' was another controversial issue in the election. Many faculty wanted the cosy option of evaluation being left within departments, but Lobo backs the move to more independent assessment. A doctorate is essential now for a staff position and Lobo claims that contracts of

# Technology the driving force

## Campinas

THE State University of Campinas, located in São Paulo state about 100 km from the capital, is often described as "second only to USP". But it is not an imitator of USP. From the time it began life in 1966, Campinas chose to give priority to science, technological research and, uniquely, links to the production sector. The first courses it offered were in physics, chemistry and mathematics, set alongside technological projects in optical fibres, lasers and computers. Next came engineering and last of all, in the 1980s, the arts.

Campinas now offers a full range of disciplines. It is very popular and has around 23 applicants for every place, making it more competitive even than USP, although it is only half the size. The campus has a quiet feel, set amid sugar cane fields in the rolling countryside a few miles outside the city of Campinas, the second largest in São Paulo state with a population of three-quarters of a million. Although the university was created at the height of the university expansion boom, it managed to keep to a policy of recruiting only the best staff. Sixty per cent of faculty hold doctorates, which is a very high proportion in Brazil, and around ten per cent are from foreign universities.

Campinas faculty like to list their university's unique features. First, almost half of its

non-tenured staff are no longer automatically renewed. Although there is no comparison with the driving pressure of the United States, USP is moving towards a more competitive environment.

Facilities at USP are the best in Brazil and will soon be even better thanks to a \$150 million loan from the InterAmerican Development Bank (IDB). The sophistication of the university allows researchers to keep up with international trends to an extent not visible at other Brazilian universities.

Researchers at the Institute of Physics, for example, were quick to replicate experiments demonstrating high-temperature superconductivity. They also jumped in immediately when they heard about cold fusion, but director Ivan Cunha Nascimento says that "after three months we decided to stick with high-temperature fusion!" The institute has a plasma-physics group and a small tokamak, the only one in Latin America. IDB funds have provided for a new molecular beam epitaxy laboratory and two new electron microscopes.

Elsewhere, the Institute of Oceanography is able to run yearly expeditions to the Antarctic where Brazil maintains an all-year-round base. That gives the geologists from the Institute of Geosciences a

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Goldemberg: centre-stage until January.

of a university campus and, quite out of place, a two-km-long rowing tank. This splendid facility was apparently built for a Pan-American games that was never held.

Ruler of this university for the past four years has been physicist José Goldemberg, a larger than life figure well known both as rector and for his criticism of the government's nuclear programme (see page 374). His term of office ends in January.

The university is big: 35,000 undergraduate students, 15,000 graduate students (half the doctoral degrees in Brazil are taken here), 5,000 faculty and 15,000 support staff. Eighty per cent of students study science, engineering or medicine. Seventy per cent of the faculty hold doctorates, the highest percentage in Brazil.

Goldemberg has been a controversial

14,000 students are pursuing graduate courses. Many are themselves teachers on release from other universities all over Brazil, giving Campinas the reputation of a 'school for schools'. Second, researchers are encouraged to build their own links with industry and even to profit from them. Campinas was the first university to set up a patent office to protect its staff's discoveries (a move which has still found few imitators). Several researchers have set up their own small companies. Third, the university has been aggressive in buying good facilities.

At the end of last year, it bought an IBM 3090, giving it the most powerful super-computer in Latin America. Next, as soon as federal funds are available, will come the National Synchrotron Light Facility. From the beginning it has had the National Center for Research in Telecommunications.

In 1986 it created a large biotechnology institute at the stroke of a pen by buying nearby Monsanto Corporation's Agricultural Research Center. Later, it complemented the centre with a Genetic and Molecular Engineering Center to train people for the expected expansion in biotechnology. Now there is an multidisciplinary programme centred around biotechnology, alongside similar integrated schemes in computers, fine chemicals, energy and new materials. The rector, Paulo Renato Costa Souza, says that his university's philosophy of trying to build integrated programmes, instead of letting everyone submit individual grants, is "completely new in the university system". □

chance to examine structures in Antarctica to which Brazil was once joined. Overall, the impression at USP is of a university that is only occasionally at the international frontiers but is frequently not far behind them.

But like researchers elsewhere, USP staff are held back by petty import restrictions. Some laboratories — the Institute of Chemistry is one — employ several people simply to do the paperwork. But the delay remains. Ana Clara Schenberg, a yeast geneticist at the Institute of Biomedical Sciences, has been waiting for one piece of equipment for four years. It is already obsolete.

Life is particularly difficult for molecular biologists. Even things such as dry ice are in short supply and items that need to be used quickly — short-lived isotopes, for example — are almost unobtainable. And, worst of all, delay destroys flexibility. "If you need to change your research programme, just forget it", says molecular biologist Bianca Zingales. Everything has to be planned ahead around the import of reagents.

Many highly trained young researchers are now returning from abroad, thanks to earlier government decisions to invest in foreign fellowships, offering the chance to push the university ahead. Unfortunately,

## Biomedicine with a bite

São Paulo

SNAKES, scorpions and spiders make the Institute Butantan famous. Its serpentarium is São Paulo's most popular tourist attraction and every year thousands of people from all over Brazil send to the institute snakes and other exotic creatures they have found in field or garden.

The snakes are essential for Butantan's function as the main supplier of antivenom in Brazil. Venom is milked from the snakes and used to hyperimmunize horses (the institute keeps 700 at stables outside São Paulo); a specific gamma globulin fraction containing antibodies against the venom is later extracted from the horses' blood. The institute maintains a small hospital, manned 24 hours a day, with a helicopter pad in front of it.

People bitten in the São Paulo region are rushed here — treatment within the first three hours is most effective. Brazil has an impressive array of poisonous snakes and more than 30,000 people are bitten each year.

Snakes are not the institute's only concern. Butantan is essentially a large biomedical research institute joined with a production facility. As well as snake antivenoms, it produces 16 kinds of vaccine. Its 1,300 staff are divided among 20 different departments of basic research and a new Centre of Biotechnology.

Naturally enough, some of its key projects involve improving vaccines. One involves cloning polio virus in vaccinia with the eventual aim of constructing a single-shot vaccine cocktail for polio, measles, hepatitis B, Willy Beçak and one of his Butantan production workers. diphtheria, tetanus and whooping cough. Another is to develop a genetically

engineered hepatitis-B vaccine, although the institute may decide to buy the technology from abroad. Projects to produce albumin and factor VIII by new techniques are also under way.

Other groups do basic research on venoms (the important vasodilator drug bradykinin was first isolated here), viruses (it is still relatively easy to discover a new virus a day in the rain forest), the genetics of amphibians and reptiles, and the isolation of natural substances from plants and marine animals.

Techniques developed at the institute are transferred free "to anyone seriously interested in production", says the director, Willy Beçak. "We're not interested in profit but to be in the at the frontier", he says; "the idea is for the institute to be an open place for people from universities; often universities are not the right place for transfer to the production sector."

The institute's popularity rose after it opened a 'reagent supermarket' in an effort to counter the effect of import restrictions.

Special permission to import reagents tax-free in bulk, together with a \$1 million grant from CNPq, enables Butantan to offer immediate delivery of a range of hard-to-import items. But it is not permitted to duplicate reagents manufactured in Brazil. □

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the returning researchers often seem quite lost — particularly those who have been at top US laboratories.

Around the campus, young people in various stages of 'returnee's syndrome' can be met. Salet Newton, who returned from a postdoctoral fellowship at Stanford University three months ago, is in the fairly early stages. "You don't know what to do", she says, "you know everything will take ten times longer than in America. There the limit is your imagination, here you are trapped by the limitations of the facilities."

A little later, the returnee struggles to see advantages. "At last I have time to read all those papers", says one. "Maybe it's a good thing that I'm forced to think instead of just rushing onto the obvious experiment", says another. Along comes the thought that one is free.

"I realized I could try some stuff that would be thought too risky over there, the sort of thing you would only do if you are already a full professor", says molecular biologist Fernando Reinach, who has no symptoms of the syndrome after three years back home. Returnees also come to realize that at USP one can attract the very best students of one's own.

The fully recovered researcher avoids the most internationally competitive areas but is busy inviting foreign colleagues for short stays (provided they agree to smuggle restriction enzymes, short-lived isotopes and the like through the Brazilian customs), using BITNET and facsimile machines to keep up, building a group in an area of his or her own, and sending off students for doctoral training abroad. Of course, there are always a few who never recover and just settle back. . . . □