



From bold ideas to innovation

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EDUCATION

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INSTITUTION

University of Campinas

The academic career of Ronaldo Aloise Pilli, Dean of Research at the University of Campinas (Unicamp), is tangentially associated with the history of that educational and research institution, which has become one of Brazil's most important. According to the Times Higher Education World University Rankings, Unicamp stands between 251st and 275th place. In Brazil, only the University of São Paulo (USP) ranks higher, in 158th place. Pilli entered Unicamp in 1973 as a member of the seventh undergraduate class to enter the Chemistry Institute (IQ). He earned his doctoral degree in short order. His advisor was Albert Kascheres, an American who was one of the many foreign professors who helped found the university. Pilli became a full professor at the IQ in 2000 after doing post-doctoral work at the University of California at Berkeley. Specializing in organic chemistry, with an emphasis on the synthesis of drugs and natural products, he has been granted many patents – not surprising at a university that is second only to Petrobras in the number of patent applications filed with the National Industrial Property Institute (INPI)

between 2004 and 2008. His innovative work has not overshadowed his career as a professor: Pilli has trained 40 master's and doctoral degree holders in the field of organic chemistry.

As head of the Office of the Dean (a post he has held since 2009), Pilli led a group engaged in strategic actions intended to further globalize the university's research. One of these elements was a program that aimed to attract foreign visiting professors who were interested in spending two years at Unicamp, with the added incentive of being able to participate in a competition for a position on the teaching staff at the end of the period. Announcements in international scientific journals attracted applications from dozens of interested parties; 11 professors were chosen and are now in Campinas. Pilli also helped reorganize the institution's research infrastructure, increasing the assistance to professors and teaching staff who were just beginning their careers and coordinating the establishment of laboratories in preparation for multidisciplinary research. Married, a father of two children and about to become a grandfather, Pilli summed up the evolution of research at Unicamp in an interview he gave to *Pesquisa FAPESP*.

You entered Unicamp as an undergraduate in 1973. What has changed in the research done by the institution over the course of nearly four decades?

Unicamp was born of a bold idea: it was established on the premise that education and research are inseparable. Gradually, extension services were also established as an end-activity. In those days, that was not the standard, at least not for Brazilian universities. Unicamp recruited its staff of professors by taking a serious look at their ability to carry out research and to teach at the undergraduate and post-graduate levels – another feature that is rather recent. This enabled the institution to distinguish itself quickly in certain fields because it was able to bring foreign and Brazilian researchers together within a relatively short space of time. In 1966, the university started implementing this system. I arrived here in 1973, and by 1976, when I finished my undergraduate work, Unicamp was already very strong in engineering, physics, and the humanities. Chemistry was beginning to develop.

There were a lot of foreign professors. More than half of them came from outside when the university was founded.

There were also a lot of Brazilians who had experience abroad. At the Chemistry Institute, with which I am affiliated, there were professors who had graduated from USP, recent PhDs who came here to accept the challenge of building a university in the interior of the state, an idea that few believed would succeed. I remember that there were professors

who refused the invitation to teach at Unicamp on a part-time basis even though they would not be required to give up their affiliation with their university of origin. It was a bold experiment. The kind of tenured professor who dictated all the rules never existed at Unicamp. Every young professor had total freedom to pursue his or her area of research. This was important in order to allow the free flow of skills and talent. Unicamp set up its post-graduate program at almost the same time as the undergraduate program, linking research, instruction, and innovation. Another feature is that the artificial dilemma – basic science vs. applied sciences – never divided our university environment. Some people had reservations against partnerships with companies, but those were neutralized once many of our best academicians had demonstrated that it was possible to reconcile a solid reputation with an eye to innovation. The issue that today is on Brazil's agenda – that we must transfer

our academic skills to innovation – has been part of life at Unicamp since the very beginning.

How big is Unicamp's contribution to Brazilian research?

If we were to add up all the production that has come out of this university, it would represent 15% of all the research done in Brazil. If we are talking about articles that have been indexed in databases, such as the Web of Science, the number is a little smaller. Unicamp is responsible for about 12% of the scientific production of this country. In 2011, we had 4,000 publications indexed in periodicals, written by a contingent of approximately 1,800 professors. This represents more than two publications per researcher, which is the highest ratio among Brazilian universities.

In what fields does Unicamp most often make headlines?

Unicamp has a long, well-consolidated presence in the natural sciences. The fields of physics, chemistry, mathematics and biology are recognized as very strong. This is clearly shown in the assessment of its post-graduate programs done by the Coordinating Agency for the Improvement of Higher Education Personnel (Capes). Many programs were given a score of 7. We see excellence in engineering and in medicine. The School of Medical Sciences has earned distinction thanks to its policy of being very selective in recruiting new professors. It is a large school, but its teaching staff is heavily involved in research. In the humanities, the Institute of Language Studies is prominent, as is the Institute of Philosophy and Human Sciences. We also offer a curriculum at the Art Institute that is playing an important role in both art production and on the academic side. Unicamp has been expanding its leadership in some other areas. This is reflected in the National Institutes of Science and Technology. We have nine such institutes – not coincidentally in medicine, physics, chemistry, and engineering.

One notable characteristic of Unicamp is its devotion to innovation. In terms of number of patents, only Petrobras ranks higher. What is the recipe for maintaining a group of researchers who are open to innovation?

When the teaching corps was recruited at the end of the 1960s, some people came from corporate research laboratories. Several instructors from the Physics Institute had spent time at Bell Labs, a world reference point at that time, and their minds were already open to the relationship between academic research in both basic knowledge and applied knowledge. We never had a system of academic chairs, and this factor allowed personal initiatives to flow. If you have complete freedom to direct your research toward an application or a deepening of basic knowledge, it is much more likely that further innovations will emerge than if you are subject to decisions from on high. Also important is the fact that professors are achieving success in the true sense of the word when their works appear in noted magazines and

Transferring our academic skills to innovation has been part of life at Unicamp since the very beginning

journals, their contributions are recognized in other countries, they are quoted, and they receive awards. We have proved that there is no incompatibility between developing knowledge, applying it to an innovation, and obtaining a patent. The university has maintained an annual volume of about 50 patent applications filed with the INPI. We also have licensing, which is more important than patents in that licensing recognizes the utility of an invention. All this explains our second place rank with the INPI, right behind Petrobrás. It's unusual, because this is not what happens in most other countries. It is a peculiar feature of the system of innovation in Brazil that a university can be one of the most important actors on the technological innovation scene. Now we need to develop the ability to deposit more patents and technologies in other countries so that we can become international players.

How are Unicamp's relationships with companies?

INOVA, our innovation agency, was established in 2003, but long before then we had an active innovation office. In recent years we have received visits and held discussions with a great number of companies. The idea is to strengthen that relationship within the context of the university's mission, which is to prepare the most well-qualified human resources and advance knowledge. Without neglecting our mission, we are willing to enter into dialogue with any agent, public or private. The funds for research come from contracts, from formal agreements we establish and sign with both state-owned and private companies. FAPESP funds cover about 40% of our research budget. Capes and the National Council for Scientific and Technological Development (CNPq) also contribute important sums. But about one-fourth of the funds for research come from agreements and contracts signed with public and private companies. Companies seek us out because they know that the university is interested in studying their proposals.

Can you mention some of the main examples?

Petrobras, Braskem, Shell, CPFL, Repsol and Microsoft are some of the companies involved in recent partnerships. There's a lot of collaboration with companies in the medical field that are interested in establishing partnerships, both for clinical trials and for basic research.

Why encourage entrepreneurial capacity even in the areas of music and dance by offering courses that prepare students to win grants under the 1991 Federal Law on Incentives to Culture (Lei Rouanet)?

Our innovation agency engages in cross-cutting activities, and that is one of them; the university not only provides our students with a good technical education but also gives them tools so that they can form their own companies, obtain financing available under the law, or become future entrepreneurs. It is a way to prepare them for the labor market, which has different configurations today. We have records of more than 200 companies having been created that have some connection with the university

– either owned by former students or incubated here. Many are doing well on the Brazilian market and others even have representatives in other countries.

During your administration, the Office of the Dean has sought to further globalize the research done at Unicamp. What have been your results?

In the first place, we have tried to convey, through very specific initiatives, the idea that the teaching staff should balance their activities of instruction, research, and extension. Of course not everyone is able to achieve a level of excellence according to the three pillars of the university, but we need to be alert to this need. With regard to support, we have detected a demand for continued institutional support to cover certain needs that the financing agencies don't cover.

For example....?

Construction of new laboratories. The current administration is responsible for three major projects. One is a highly developed central technology laboratory that would provide services to the fields of genomics and proteomics, bioinformatics and cellular biology. We received support from FAPESP through a request for proposals issued under the Multiuser Equipment Program, and the university is investing R\$6 million in construction of the building. Another initiative is the São Paulo Bioenergy Research Center, which involves all three São Paulo state universities. FAPESP participates in this program by financing research projects. We received R\$15 million from the state government and are using it to renovate an area of 4,000 square meters to house laboratories. We are building a headquarters building measuring more than 1,000 square meters and finalizing contracts with five instructors who will work in the field of bioenergy. Our budget for 2013 calls for hiring five more instructors. Added to the number of researchers now on staff, there would be 50 staffers working in bioenergy. Through an internal request for proposals that recruited outside consultants to evaluate the proposals, we offered the possibility for contracting senior technical personnel to assist research groups that have solid reputations in their specialty fields and recognized fund-raising ability. Forty-five hires were authorized for groups that are supported by thematic projects, National Institutes of Science and Technology (INCT), multiusers, and international collaborations. Lastly, we established the Integrated Research

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Laboratories (ILP) to accommodate interdisciplinary research projects. That structure will house researchers for specific periods of time so that they can carry out projects financed by foreign sponsoring agencies. We also issued two requests for proposals on infrastructure, to renovate certain research laboratories. Unicamp was a pioneer in setting up a researcher support unit whose primary intent is to help researchers in preparing progress and project outcome reports, and free them from some administrative obligations. Today there are five employees working locally, and two others in units where there is a high demand for those services and, because the units have obtained funds under FAPESP thematic projects, they have qualified to have one staff member to manage those projects.

Is the support tied to the ability to raise funds?

Once they are working on three thematic projects, a unit may ask the Office of the Dean of Research to assign it an employee who will provide administrative project management services. This is tied to fundraising. We

have to have a counterpart to the investment that the university will make via payment of salaries and other benefits. We hope that this trend continues and that the units will increasingly be able to justify the hiring of that kind of professional to assist them in managing their activities.

How has the university been able to renew its corps of researchers?

We have experienced a strong increase in the hiring of teaching staff. For

the coming year, we expect to hire 75 new instructors, lecturers, etc. We need to offer them the conditions for beginning their work so that they can assemble their groups, raise funds, and attract students. We give them a modest initial assistance package that amounts to almost R\$50,000 each. An individual can request R\$15,000 of that total as soon as he or she submits an application for research assistance to some Brazilian or international sponsoring agency. The money is used to adapt a workspace, purchase equipment, reagents, and so on. Then, if that aid is approved, the individual is entitled to a grant to fund a master's degree. Young instructors frequently have trouble finding advisees because they are still building their academic reputations. This allowance helps ensure that they will have a master's degree candidate to advise. Today, we also have about 1,500 grant recipients in the area of undergraduate research. If that young instructor can couple that initial aid package with some grant

recipients working on undergraduate research projects, in one or two years he or she will have assembled a small group of researchers that will be able to consolidate itself and attract other researchers in the future.

How is the effort to bring in foreign professors going?

Although Unicamp was born with hefty support from international experience, over the years, for various reasons, that component ceased to be as strong as it originally was – a trend that portrays the Brazilian post-graduate education system. One of the initiatives we established seeks to attract teaching staff from abroad. A Brazilian who has settled abroad, or a foreigner who wants to come to Unicamp can be appointed to staff a unit of instruction and research under the visiting professor program. The only obligation such a unit has is that by the end of the second year, a competitive examination will be opened in the area in which that instructor specializes, since the invitation for him or her to come means that he or she works in a field of strategic importance. If the unit needs an expert in numeric systems, it may invite a well-qualified researcher in that field to stay here for as long as two years. And so that person becomes familiar with our university system and enables us to get to know him or her well, and, at the end of the period, that individual can take part in the competitive exam. We now have 11 professors in this program. Seven are foreigners and four are Brazilians who had gone abroad and have returned. We also make funds available from our budget to support short-term visits of between 15 to 60 days by foreign researchers who are distinguished in their fields, in order to accelerate the process of getting our younger teaching staff involved in international collaboration. Instructors who have approved proposals receive funds to enable them to visit the partner laboratory outside Brazil for the same period of time. Under both kinds of visits, there was provision for a doctoral or post-doctoral student to visit the partner laboratory.

Why are rankings of academic performance important to the universities? What has Unicamp been doing to improve performance?

Unicamp is a medium-sized university whose mission is to achieve quality. We have about 30,000 students. It's not likely that we'll eventually have more than 40 or 50 thousand students. Scientific production is increasing in a natural way, but there are no indications that the university will ever be numerically bigger than it is now. When we look at the ranking, we ask ourselves whether it is measuring the quality of production by the university, or the quantity. By any standard of measurement, Unicamp is one of the best in Brazil – for example, when you compare the numbers of post-graduate courses scored at 6 to 7 in the Capes ratings, or academic production per professor, or number of applications for admission to the post-graduate program or to undergraduate courses. We are encouraging our units to enter into a dialogue with noted foreign institutions. Several workshops have been and will be held with universi-

Unicamp's mission is to achieve quality. We're not likely to have more than 40,000 or 50,000 students

ties of international renown. The expectation is that this will create more lasting ties. We are not interested in sending students abroad for six months and getting them back. That doesn't change the perception that the world scientific community has of Unicamp. We have to engage in major projects and collaborative efforts and see that our work obtains greater visibility.

I would like you to talk about your personal experiences – the three periods you spent outside Brazil.

I did post-doctoral work for two years at the University of California at Berkeley and then I had two short stays as a visiting professor in Germany and England. I'm from a generation that believed that post-doctoral work abroad was mandatory. The entire academic community used to expect that after earning a PhD, one would go to a famous university in another country, then return and establish one's own line of research. I was helped by my doctoral advisor, Albert Kascheres, an American, in making a choice from among competent groups that I could join abroad. I had the good fortune of going to the group that was prominent in my field, which is organic synthesis. I was able to learn, come back to Brazil, and establish a laboratory for asymmetric synthesis and natural products. Until then there had been no concentration of efforts in that area, which was growing in importance in the synthesis of medications, in agriculture, and in foods. My career began in 1973. After four years of undergraduate work and four more years of doctoral studies, I went to the University of California at Berkeley. I returned at the end of 1984; 1985 was my first year as an independent researcher here. I have done 27 years of work in organic chemistry and have trained more than 40 post-graduate students plus 20 students in undergraduate research. Currently I am gaining administrative experience as director of the Chemistry Institute and as dean of research.

I would like you to talk about your contributions as researcher. Your field is organic chemistry. How did you happen to become interested in it?

My training is as a chemist, and my specialization is organic chemistry, which deals with the transformation of simple organic matter into more complex products. I began my doctorate by studying some cycloaddition reactions, which is an important family of organic reactions – studying them from the methodological standpoint, i.e., looking to see in which situations the reaction might occur and how it would occur. In my post-doctoral work, I went on to study synthesis, the laboratory preparation of natural products, of chemical substances found in nature and that have some practical use but cannot be extracted from nature in sufficient quantity. Drugs are an example of this. Many drugs were inspired by natural products, but nature cannot supply the quantity required in order to treat great masses of people. This is where organic synthesis comes in, because it produces in a laboratory that which nature took billions of years to develop and in quantities that permit access by a large number of

people. I went to do that post-doctoral study in an area of synthesis of the antibiotic erythromycin, which at the time was the holy grail of organic synthesis, one of the most complex structures that could be synthesized and produced in a laboratory. When I returned to Brazil, I applied the same methodology to a different area, which is pheromones, substances that insects use to communicate. Many pheromones have direct and important applications in agriculture. At that time, the substances were not as complex as those I had studied during my post-doctoral years. The structural conditions available to us enabled me to apply that knowledge in a domain that was less complex – but not for that reason less important, because those substances are used to control pests. As the conditions for research improved, I began to get involved in the synthesis of more complex drugs and natural products, as well as catalytic methods for synthesizing natural products. Today my focus is on linking my skills in organic synthesis with the field of medicinal chemistry. I work with various groups so that what I produce in the laboratory can be tested with respect to different biological activities, such as anti-cancer activity.

You have two projects involving cancer, don't you?

I have a thematic project under way that attempts to combine different areas of knowledge in a search for new structures that might be able to interfere with cancer cell metabolism. We have several colleagues who are working on the new molecules synthesis part; we have groups that are handling the structural biology part, enzymatic activity, pharmacological studies, etc. In short, we have put different skills to work together so that we don't have to end our work only with the production of a new molecule; instead, we can evaluate its potential and from that point redesign new substances that may have even more interesting properties than those we have observed. It's an interface between organic chemistry, medicinal chemistry, and an area known as chemical biology, which is the use of chemical tools to understand biological processes. It's a natural evolution for someone who began by studying rather basic processes and gradually moved on to the synthesis of more complex natural products. That in turn led to the application of that expertise in collaboration with groups that are able to evaluate the biological activity of that compound. These days, you can't just consider developing new molecules without evaluating their implications, whether as new materials with pharmaceutical potential, pest control agents, or something else. ■

Organic synthesis produces in large quantity that which nature took billions of years to develop