She fights for science

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Helena Bonciani Nader, full professor at the Federal University of São Paulo (Unifesp), was re-elected president of the Brazilian Society for the Advancement of Science (SBPC) last month. As the most representative body of Brazil's scientific community, the SBPC has approximately 110 affiliated societies and over 4,000 active members. After serving two terms as vice president and one as president, Nader will continue leading the association until July 2015. In recent years, she has been a salient force in the organization of successful campaigns, such as the effort to overturn a provision of the law that defines the career plan for federal university faculty; the clause in question would have abolished the requirement that all candidates applying for the post of professor hold a doctorate. Other crusades still underway include the battle to have a portion of the royalties earned on oil production assigned to science and another campaign to boost funds for science and technology. Nader did her undergraduate work and obtained her doctorate at Unifesp, when it was still the Paulista School of Medicine; she did post-doctoral work at the University of Southern California (USC). She is the lead investigator of a group that has set the world benchmark for research on heparin, a polysaccharide known for its role as a blood thinner. The group was created by Carl Peter von Dietrich (1936-2005), Nader's doctoral advisor. The two later married and had a daughter. Nader has trained nearly 100 researchers at the master's and doctoral levels, and she is quite happy to continue teaching at the undergraduate level, where, she says, it is easier to instill values in students. She is also biology coordinator at FAPESP and is an honorary professor of the Federal University of Rio Grande do Norte (UFRN), where she helped establish a biochemistry research group. In this interview, she looks back over her career and her work with the SBPC and discusses the organization's plans.

SPECIALTY
Glycobiology

EDUCATION
Federal University of São Paulo (Unifesp) – bachelor's degree and doctorate
University of Southern California (USC) – post-doctorate

INSTITUTE
Federal University of São Paulo (Unifesp)
Brazilian Society for the Advancement of Science (SBPC)

SCIENTIFIC OUTPUT
248 scientific articles indexed in the Thomson Reuters database; advisor for 43 doctoral and 45 master's candidates

LÉO RAMOS

In the SBPC's view, what are the main challenges facing Brazilian science?
Brazil is going through a new phase in education and science that is marked by both greater demand and a demand for higher qualifications. When the SBPC was founded 65 years ago, Brazilian science was still very limited; it was restricted to some fields of knowledge and to some places in the country. Today, science is being conducted all over Brazil, and I see this as a victory for the entire scientific community. The overall picture is very good, but we need investment. That's why we're fighting for more funds for science. Investments have risen, but they still fall short of our needs. The private sector has been investing, but at a lower rate than the business sectors in China or Korea, for example.

Is there still an imbalance between states within Brazil?
There are differences. There's one scenario here in São Paulo. The picture is also extremely favorable in Rio de Janeiro. Minas Gerais is now investing more than Rio, proportionately speaking. I'm very proud because the state of São Paulo plays a very valuable role in Brazil's scientific world. We have led the pack. The state constitution of 1947 provided for the establishment of a research funding agency, whose growth has kept pace with the confidence of the scientific community and, quite notably, of the political community. FAPESP managed to become a force in the political arena, and this has been fundamental. When the new Brazilian constitution was written in 1988, it stipulated that all states should have such agencies and should support science, research, and technology. Our FAPESP has been fundamental. I remember how Flávio Fava de Moraes, who was FAPESP's scientific director at that time, traveled the country. Prof. Dietrich and I were setting up a graduate program at the UFRN in the 1980s, and we ran into Moraes at a hearing in the legislative assembly there, where he was showing the impact that a research agency can have. Science had been around longer here. We already had the Campinas Institute of Agronomy and the Butantan Institute, which are over 100 years old.

The establishment of the University of São Paulo (USP) was perhaps the major milestone.
The fact that we lost the Constitutionalist Revolution in 1932 had a huge impact on São Paulo society. The establishment of USP in 1934 – almost a type of compensation for our defeat – attracted European scientists who were being persecuted for political, religious, and ideological reasons. São Paulo was already a strong state, but its coffee plantations were in crisis. If our young people wanted to study medicine, they'd go off to Rio or Bahia, because São Paulo had only one school of medicine, which was not yet part of USP, located on Dr. Arnaldo Avenue. There were no federal investments. Another institution, the Paulista School of Medicine, was born in 1933 as a private institution and remained so until the mid-1950s. Our state infected the others. As a native of both the city and state of São Paulo and as a Brazilian, I'm proud to say that São Paulo State helped with this process. However, I also recognize that São Paulo needs to have a greater presence, given the dimension of its science, and should not distance itself for reasons related to party politics. This hurts dialogue. There was a time when you could have seated people from different tendencies at the same table, but now you can't because they criticize each other. It shouldn't be like that. I think this is changing, and that's good. Thank goodness we're a democracy; thank goodness power changes hands. We have to present common grievances; this is essential to Brazil.

The SBPC recently led the campaign to overturn some provisions of the law on the career plan for federal university faculty. Were the results satisfactory?
After we read the draft of the law, we sent a document – signed by Jacob Palis, President of the Brazilian Academy of Sciences, and me – in which we clearly explained the harm that this law would do; unfortunately, it fell on deaf ears. The law was passed on December 28, 2012. After it was approved, I'm proud to say that the SBPC was the key agent behind President Rousseff's provisional measure, which re-instates the requirement that a candidate to a professorship at a federal university must hold a doctorate – because the law had done away with it. That was absurd. Brazil's graduate schools are being copied abroad, and, just like that, they pass a law saying, "Look, you want to be a professor at a federal university, all you need is an undergraduate degree." It was overturned. However, one important item still hasn't been reversed: the new law must be brought in line with the Technological Innovation Act so that professors working under the so-called 'exclusive commitment regimen' can undertake projects at private companies, as long as this doesn't get in the way of their teaching duties. At São Paulo's state universities, professors working under this regimen can allot one day a week to this type of work.

Two causes taken up under your administration were the reaction to the 2012 budget cuts and the question of petroleum royalties....
We now have a partnership with the Brazilian Academy of Sciences. We complement each other; together, we represent the whole scientific community. Some view academia as a restricted world. They think we academics sit on our thrones up here, with the masses down there, but that's not true. Academia represents the elite, and in Brazil, 'elite' is a worn-out word. However, the SBPC represents all of the country's scientific associations. That's 110 scientific societies. When Jacob Palis and I sign a document, it carries tremendous weight. One cause that we took up was the restructuring of the budget after the 2012 cuts. This year, according to Marco Antonio Raupp – the Minister of Science, Technology, and Innovation– President Rousseff said that one can no longer trim the budget by downsizing allocations to the Ministry of Science, Technology and Innovation (MCTI) or to the Ministry of Education. We've managed to show our leaders the importance of science and education.

Do you think the MCTI budget is satisfactory?
Science and technology saw an increase in funding, and there was a substantial increase for innovation. The partnerships between the Brazilian Development Bank (BNDES) and the Brazilian Innovation Agency (Finep) also yielded an important increase in budget. Could it be greater? Of course it could.

But how are funds from the perspective of university research?

In our opinion, funds are still limited. We've spoken to Minister Raupp about this. We put it on the table at a recent meeting chaired by the Minister. He noted that they had boosted funds for the so-called universal grants available through the National Council for Scientific and Technological Development (CNPq), which are open to any field of science, technology, and innovation, but we had seen that financing for individuals had dropped. I said, "Minister, in the past, we could ask for up to R$150,000 over two years. That was R$75,000 a year. For the most senior scientists, the total is now R$120,000, divided over three years." He hadn't realized that. There was an improvement, with a greater number of grants based on outstanding scholarship. New universities were created, and a greater number of doctorates were awarded. Unless investments are guaranteed, you end up doing away with researchers. We have to fight for more funding. Partnerships between the federal and state governments have proven successful and should be more commonplace because this means resources are combined and there are savings in the end. For example, we need the continuity of the National Institutes of Science and Technology (INCTs), which are financed by the CNPq and by state research support agencies. We want this July's evaluation of the current INCTs to be transparent and to identify which INCTs have been successful, or else the initiative will lose credibility. If something's not working, you don't continue funding it. There's pent-up demand, and the solution is not to take away from one and give to another. We have to go after funding to meet everyone's needs. The evaluation of the Science Without Borders program must be just as clear.

What is your evaluation of Science Without Borders?

I met students with fellowships in the United States. I had a fantastic impression. There were undergraduates, and there were post-doctoral fellows. Their enthusiasm was remarkable. Unfortunately, what comes out in the newspapers is that we've got recipients in Portugal. Not that Portugal isn't a good place to go. They've got the immunologist Antonio Coutinho's laboratory, which publishes its work in nothing but Nature and Science. The SBPC would like this program to be evaluated, as we here in São Paulo would also like the FAPESP Research Internships Abroad (Bepe) program to be. We've been sending many students abroad, from the undergraduate to post-doctoral levels. What's the impact? The SBPC feels that Science Without Borders is a daring program that is a challenge to administer but might have an impact on Brazilian education and science. Our universities are obsolete. We're offering undergraduate courses based on a nineteenth-century model, not even a twentieth-century one. A student comes back changed after spending time abroad. Here, professors give a general class and then tell their students, "Now go study." When it comes time for teacher evaluations, the student writes, "The professor didn't fulfill his workload." Students want classes on theory; they want to study from their notes. I talked with students abroad, and they said, "I never thought it could be like that." The professors tell them to go study and then call the students in to discuss.

Sometimes articles are turned down and then similar data appear in the same journal. Is this a coincidence?

Is English still an obstacle?

I don't want to generalize, but it's not a problem only for students. Our scientists have language problems. Many people wonder why Brazilians don't get published in the top journals. It's because of the language barrier. The Chinese didn't use to publish in the top journals either. Now they publish in Nature and Science all the time. However, they hired people with training to write according to the journal model. Fifteen years ago, the Chinese spoke English all wrong. Today, they don't even have an accent. However, they have an educational tradition that we lack. You can forget about freedom there – something I refuse to give up – but they've got education. Children really go to school; they're learning. There they decide which university will do science. Our researchers don't know English like they should. It would be good to have people at our universities who could help write articles because it just keeps getting worse. They're selling this service now. I'll give you an example. I recently sent an article to a journal. Since everything's online, they saw that the IP address was from Brazil. One reviewer praised the paper, the second one made some critical comments, and the third said it needed extensive English editing by a native speaker. I replied that I trained in the United States and that the article has two other authors, one English and one American. It's become a habit to complain about the quality of the English, even if there's no problem with it.

Why is that?

They're selling these services. It's a business. This issue gets into the question of scientific ethics. Today, there's a lot of talk about the integrity of the researcher and his or her relationship with students. However, integrity goes beyond that. Sometimes, the editors of journals and their reviewers lack integrity. I've seen this happen; an article is turned down, and then similar data appears in the same journal. Is this a coincidence?

It's easy to blame someone for lacking ethics when the results aren't reproducible. Plagiarism is harder. How can you prove that someone didn't have the same idea? The pressure for funding is great. The number of articles that repeat the same finding is amazing.

The campaign over petroleum royalties was unsuccessful. Why was that?
We've lost the royalties from new petroleum contracts, but we're still fighting so that part of the funds that go to education will be allocated to science. It doesn't do any good to invest only in basic education. I remember what happened under the Fernando Henrique Cardoso administration. There was investment in basic education, but federal universities were left to starve. That's wrong. You've got to invest in the whole system. That's the only way to raise the bar. Unfortunately, the government today is looking at royalties only as a way of obtaining 10% of GDP for education. What we've apparently managed to do is ensure that CTPetro funds – which support research in oil and natural gas – will not be cut in the case of oil fields where bids have already been made. However, it hasn't been voted on yet; we have to stay on top of it. We're also paying close attention to the science, technology, and innovation code. I've been attending the public hearings. The law that governs universities is number 8.666, which wasn't written with science in mind. It's actually anti-science.

What do you mean?
Here at Unifesp, we had to return money to Finep because it was impossible to use the funds. We were the first university to create translational medicine. We submitted a project, which was approved by Finep, but we couldn't use the money. Every single construction tender ran into trouble with the Office of the Prosecutor for the Public Interest and with the Federal Audit Court (TCU). The way the law is now, it blocks spending. At a public hearing of the committee chaired by Rep. Gabriel Chalita, which I attended in Brasília, there were representatives of the Audit Court and the Office of the Attorney General. I offered a number of examples. I noted that it had been necessary to devise specific legislation for the World Cup and the Olympics, without which these events could not possibly be hosted. Are the World Cup and the Olympics more important than education and science? I'm going to keep asking this question. We're also fighting for more streamlined laws on biodiversity. Look at how companies such as Natura have been penalized and how they've been showered with lawsuits. There are more publications on Brazilian biodiversity abroad than here in Brazil, and we keep seeing this. I think this trend is anti-Brazil. If the young people who have taken to the streets want some causes, I can give them several. We are also paying close attention to enforcement of the National Education Plan (PNE). The salary that teachers had been promised hasn't come through.

I'd like to talk a little about your career. You spent some periods in the United States, but you didn't want to settle there. Why not?
I went to the United States for the first time when I received a scholarship from the American Field Service. I went to Pennsylvania, where I spent my senior year of high school. When I got to the United States, I took a test, and they put me in advanced placement (AP) math, which is equivalent to the first year of college math. I studied differential and integral calculus, AP chemistry, and AP English. I got a lot out of it, and I graduated there. My grades were very good, and I received a scholarship to go to college in Pennsylvania, room and board included. However, by the time I found out about it, I'd just returned to Brazil, and I said, "I'm not going." I don't regret it. I went to college here, at the Paulista School of Medicine. I was in the second class of the biomedical sciences course. I could have gone on to study medicine; this was guaranteed. However, I didn't want to because at some point I decided, "I want to do science."

When did you realize you wanted to be a researcher?
Early on in my coursework, because of the challenges in the laboratory. We had a lot of laboratory experience. Nobody taught classes. They told us to study: "Here it is. It's this chapter." Nobody asked if we knew how to read English. It was all in English. It was an innovative course. The more they demanded of us, the more we liked it. It was a small, very close-knit class.

You met Prof. Dietrich in your fourth year, correct?
I was already doing an internship in biochemistry, working with Prof. Leal Prado, when Prof. Dietrich returned from Canada, where he had spent six years and even become a citizen. He was a young prodigy, headed towards a full professorship at the age of 33. Prado didn't ask me what I wanted. He just said, "Look, you're going to work with Prof. Dietrich," and gave me a bunch of papers to read. I did an internship with him in my fourth year of biochemistry and then went straight on to my doctorate. I defended my PhD in 1974 and then spent a year and a half doing a post-doc at the University of Southern California (USC) in Los Angeles and at the Veterans Administration Hospital in San Fernando Valley on a Fogarty grant from the National Institutes of Health. My résumé was already very strong. I had published a lot. I published one paper as an undergraduate and, I think, ten or twelve as a doctoral candidate. Curiously enough, I decided to work with Walter Marx, who had conducted pioneering research in the study of the biosynthesis of heparin. I've always been involved with glycosaminoglycans, especially heparin. I chose this laboratory because of the references I'd seen in the literature, but I didn't know that it had been practically shut down. They called me in for a meeting at the Fogarty Center and told me: "Do you know we've talked a lot about your case here? Given your résumé, which is not run of the mill, we were struck by the choice you made." I said: "I didn't know. If you were aware of this, it was your obligation to tell me." They replied that they wanted to see how I'd handle it. I paid a high price, having to set up a laboratory, when what I wanted as a post-doctoral student was to take advantage of the structure of a large laboratory. However, I proved that I'm capable. I arranged to collaborate with a researcher who was developing mastocytomas, which resulted in a paper. I had to start from scratch. I cut acrylic – people would come around to watch – and I made my electrophoresis boxes.

And then you came back to Brazil.
I came back in 1977. Then, in 1978, I spent three or four months in Modena, Italy, because an industry asked for help identifying all of the components in a natural product of animal origin that was being sold throughout Europe. The challenge was not only identifying the ingredients but also obtaining 100 grams of each component. Ninety percent was nucleic acid. Just think – I had to get 100 grams from each of them. I acquired recognized experience in analyzing heparin. We are providing a model here. Prof. Dietrich set it up. I had the privilege of starting with him and of continuing as his partner. Before he passed away, many people thought that I produced scientific research because I was with Dietrich. This always upset him a lot. We got married and had a daughter. After that, whatever I produced was because he was a leading scientist. He'd then say, "These people don't understand anything; I'm the privileged one." I'd reply, "Then that makes two of us." We complemented each other. I miss him very much. Very much indeed. He was my friend. We exchanged ideas. However, I keep on producing.

Speaking of your contribution in the area of heparin, when did it start?
It started with my doctoral dissertation. Prof. Prado had brought Prof. Gordon to Brazil from a London university. He was one of the pioneers in isoelectric focusing (IEF), a technique that is still used today to separate proteins and peptides based on their isoelectric point. You have a mixture of proteins, and you see them separate. They stop at different times during electrophoresis. So I said, "Gosh, I'm going to do that with heparin." It was the first piece of literature that showed that heparin has different components with different molecular weights, and it is the only compound among the glycosaminoglycans that displays these characteristics. The method was used in industry to characterize heparin. This work dates back to 1974. We were the first laboratory to show that biological heparin activity has nothing to do with pharmacological activity. We published a paper. By that time, I was already serving as an advisor, and in this case, my advisee was Anita Straus Takahashi, who showed the distribution of heparin in some tissues. There was also a publication with folks from the Biological Institute. Osvaldo Sant'Anna had the mice, which he selected by immune response. A mouse that produces lots of antibodies has little heparin in its skin, and the one that makes few antibodies has lots of heparin. Moreover, female mice have twice as much heparin as males. We even showed the distribution related to gender. It was a very nice piece of research. We saw that the distribution of heparin was associated with the organism's defense mechanisms against pathogens. In one experiment, we administered endotoxin, and the mouse that produced large quantities of antibodies died quickly, while our little buddy who didn't know how to make antibodies survived. Then, we got to examining heparin in invertebrates. The clams that you eat in pasta are full of heparin, with the same tissue distribution as in vertebrates – if you substitute 'lungs' for 'branchia'. Our laboratory drew up the phylogenetic tree of glycosaminoglycans. Heparin and heparan sulfate are our lab's two flagships.

In my undergraduate studies, I had a lot of laboratory experience. The more they demanded, the more we liked it

Where is this research now?
In terms of heparan sulfate, we have a very large focus on its role in endothelial cells, because the endothelium in itself is an antithrombotic system because blood has to go through it. Heparan, heparin, and our compounds have turned into stars; things have actually gone a bit overboard. There's a great deal of collaboration in Brazil and within our university. I'm proud of this. Many medical students and doctors are here conducting their work. I have a collaborative effort with ophthalmology. The student who did his doctorate with me won an international award; he then went to the New England Eye Institute and Tufts Medical School. Today, he's an assistant physician at the Paulista School of Medicine and a lecturer at Tufts Medical School. Using a choroidal neovascularization model that he set up, we demonstrated the role of a glycosaminoglycan (that we isolated from shrimp head waste) as an angiogenesis inhibitor. I'm working with cancer cells through angiogenesis. I have a collaborative effort going with orthopedics and with plastic surgery, morphology, nephrology, cardiac surgery, and urology, among others.

How many researchers have you trained?
Almost one hundred, including master's and doctoral students, but not counting post-doctorates and undergraduates. A number of those who did only their master's degree with me are now working at laboratories in private enterprise. Those with doctorates are at research laboratories and universities around Brazil and abroad. It's good to see their success and see that they're outdoing you. I was thrilled when Selma Jerônimo, who did both her master's and doctorate under me, was recently published in Nature Genetics. I said, "The daughter has surpassed her mother." The paper has international co-authors, but the experiments were conducted at Selma's laboratory in Rio Grande do Norte. I think that this is a legacy. ■