

# Luiz Meirelles

Many Brazilians dream of studying abroad. Perhaps to build a career in another country or just to make a true contribution for Brazil in the field of science and technology. What if this contribution positively affects the improvement of a product that benefits hundreds of patients? In this case, we would be talking about a young prodigy named Luiz Augusto Meirelles who gave us this amazing interview. It was in 2007 that we had the grateful surprise to meet Luiz. We organized a group of people that went to Gothenburg, Sweden, to participate of the first Brazilian Day (Dental Press Magazine, Periodontics Implantology, v. 1, n. 3, p. 110-111, jul./aug./sep. 2007). We had many lectures given by professors from Sweden and Brazil, in a scientific exchange very beneficial to our team. On the following day, we watched the interviewee's thesis defense. Actually we saw a young man to be truly massacred with objective questions, sometimes aggressive, from his accuser (Professor Lyndon Cooper, USA), regarding his works in surfaces of implants, especially in nanotopography. However, for our joy, he not only did very well, but also was applauded by his compatriots and by the Swedes present at the end of the works. Today we have a friend who exercises the teaching and researching at the University of Rochester, in the U.S., and that at 37 years of age is already quoted by the most renowned researchers, as one of the world's leading authorities in the field of surfaces of osseointegrated implants. Luiz Meirelles graduated in Dentistry in 1998 at the Federal University of Rio de Janeiro and worked in different research projects in the area of osseointegration during scientific initiation. In 2001 he started the master's degree at the Faculty of Piracicaba (Unicamp), analyzing the distribution of stress on implants through a photoelastic analysis. He concluded the program in March of 2003 and initiated the doctorate at the University of Gothenburg in the same year. His doctorate program was focused in modifications on the surface of dental implants, characterizing the nanostructures with an innovator model. He defended his PhD thesis in 2007, being one of the pioneer researchers on the evaluation of bone response related to nanotopography. Today, he works at the University of Rochester as Assistant Professor of the Eastman Institute for Oral Health and the Faculty of Bioengineering. He is the head of a laboratory of research in biomaterials and works with patients in rehab. Luiz Meirelles is married and father of twin girls.

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### **How did you initiate the process of studies in osseointegration?**

One day, walking by the Faculty of Odontology at UFRJ, I found an advertisement looking for an intern to work in a CAPES project with participation of Fiocruz, Military Institute of Engineering and Brazilian Institute of Implantology. The project was one of the first that evaluated the titanium dental implants produced in Brazil. The idea was to develop a national industry and make the Brazilian implants competitive in relation to the imported ones. The internship scholarship did not happen, but I, finding the project fantastic, offered to work anyway. It was my first contact with scientific research, on my second year in college. I met at this time the professors Carlos Nelson Elias and José Henrique Cavalcanti, among others that were part of this pioneer project.

### **Was there already a governmental policy thinking that it really was a scientific industrial development niche?**

Of course. But the national industry, by that time, was initiating the manufacture of dental implants. There was already manufacture of prosthetic components, but implants were not yet a concrete reality accepted by everyone. There was a need on the market, the necessity to develop a national industry. Imported implants used to cost a very high price besides we suffered with storage and replacement of components. It was by this time that I started working with rabbits and animal experimentation at MIE and Fiocruz, between 1995 and 1996. I would go to Fundão's library after class and read and study about osseointegration. A lot of references from professors Brånemark and Albrektsson! I was impressed by that and on that moment I decided to study and learn with them. This was something already settled in my head.

### **What were your plans?**

In 1999, on my first year as graduate I went to a congress in Denmark, at the European Academy of Osseointegration.

By that moment, I had already decided I would doctorate in Gothenburg. I contacted some people by e-mail introducing myself and they said that there was a possibility but I would have to raise the money because they could not sponsor me.

### **So you had already contacted Gothenburg?**

Yes. I sent an e-mail presenting my ideas for the doctorate program. Before the congress in Denmark (EAO, 1999), I exchanged e-mails with some researchers of the area, probing how it could be done. I had assistance from the professor Cláudio Fernandes and got to visit some universities in Scandinavia. This first contact was important and I got to define goals of what needed to be done. I visited the University of Gothenburg and talked to some people from the Department of Dental Prosthesis. Then I literally knocked on the door of Stig Karlsson — who was the head of Prosthesis — and said I wanted to work with implant. He said he had a person there that worked exactly with what I was talking about. I was introduced to professor Ann Wennerberg (my future supervisor) and, from this meeting, I already had some goals for my PhD. I went to Brazil and enrolled CAPES in 1999. My project and my resumé were approved but I did not get the scholarship under the argument that I was too young and did not have a master's degree.

### **Therefore, you decided to do the master's degree?**

I did against my will, because no one in Brazil was doing what I wanted nor had technology to do it. When I was in Gothenburg, they found the idea very interesting, but said they did not have money. Actually, they did not want to sponsor someone they barely knew. I did the masters course at Unicamp, already intending to go to Gothenburg for PhD. By this time, I had already published some articles. I did a productive masters program, was an intern at Fundão for a good while, taught in remarkable places,

published a lot and, sometimes, I would write to Ann Wennerberg saying that the project was still up and that as soon as I finished mastering, I would go there.

### **At this point you already felt Gothenburg's receptivity?**

I never asked myself this question. I'm meeting Tomas Albrektsson, in Chicago next week, and I'm going to ask him that, it is an interesting question! When I was there, the impression I had was that they found me very determined.

### **What happened at the end of your masters program?**

When I finished the masters course at Unicamp, I applied for full doctorate by CAPES and by CNPQ. CAPES approved the full doctorate and I had the chance to do it in Gothenburg. I defended my thesis at Unicamp in March of 2003. In September of 2003 I started my PhD.

### **Did Elias have any influence in all of this?**

Professor Elias (Carlos Nelson Elias) is a prominent researcher and sent a recommendation letter. When someone like him gives a recommendation, saying I'm capable and have means to accomplish the doctorate, they consider it.

### **How was the beginning in Sweden?**

To be honest, already in September of 2003 I took the project approved by CAPES, translated it to English, reformatted on the standards required by the University of Gothenburg and presented to Ann Wennerberg. This project would have to be accepted in the University of Gothenburg as a doctorate project. We did several alterations and, around this time, the professor Tomas Albrektsson started to participate in our meetings.



View of Rochester's downtown, divided by Genesee river.

### **Your doctorate research was in Osseointegration or Prosthesis?**

It was a little bit of both. I wanted to evaluate the influence of micro-motion on the bone response. My idea was to determine that this value would probably change depending on the healing stage of the implant. It was an ambitious project for a masters thesis and, with the professor Altair Cury, we decided for an *in vitro* model, evaluating the distribution of stress between implants with external and internal connection, through photoelastic analysis.

### **Was there any Brazilians linked to Gothenburg by this time?**

Not that I know of, but professor Maurício Araújo had defended his doctorate in the Periodontics department.

We talked a couple of times by phone before I moved there. He was very generous, giving me a lot of tips about the city, which tranquilized me.

### **What is the sensation of knowing you would work with professor Albrektsson?**

The first time I set down to talk to him was a unique experience. I was a stranger, so in the beginning everyone was apprehensive. I would have to prove my purpose. They thought that four years was too short to finish and that I should start working immediately. One or two months after my arrival, the project was accepted as PhD thesis, although there, usually, it takes over four years. Everyone was committed to me to finish within the deadline. Therefore, it all was very quick. Professional and efficient, Tomas Albrektsson is a rare personality. His reasoning is different, he evaluates everything through an angle we are not used to. It was a great learning and a very productive experience. Today I strive and try to focus on problems through this same angle. I'm not very sure if I succeed, but if I ask his opinion he will say I'm on the right direction. He always encourages you, making it clear that the process of professional maturity involves decision-making, right or wrong, it does not matter. It was amazing to listen, from a researcher like him, a very simple answer during the project discussion: "I don't know, we'll have to wait the results". Today, several innovations we are using were developed under Tomas' orientation. It is awesome to assess how his personal mark is present in several products.

### **Was it already in your plans to study nanotechnology?**

No, my project would evaluate the biomechanics of bone-implant interface.

### **How was your first cultural adaptation?**

In business hours, from 8am to 5pm, everything was great: I had my own office, my computer. They told me

how to buy a laptop and how to start working on the project. I had a lot of trouble to find an apartment and little things became complicated for a newcomer. But I think this all is part of the growing process.

### **Do the rules for doctorate in Gothenburg are the same as in Brazil?**

It depends on your dedication. There are professionals that do the doctorate in part time, a very interesting model. They are people who work at the university and can, in parallel, dedicate 50% to doctorate, still keeping their full salary. A lot of people do this and, therefore, the thesis there turn out so strong. You are paid and have time to read and study. There is always meetings of the research committee. Everyone discuss the ideas, it is a very good experience. In Brazil, it is rushed. You revise a doctorate thesis while having lunch, you take someone's thesis and it is coffee stained... It is too little support and too much dedication.

### **When did you enter the nanotechnology project?**

In my first thesis article, I wanted to know the limit of vertical movement that would initiate the bone loss. Much of what was published in this area is with analysis of finite elements, which does not give the final biological answer; there are several limitations. There are a few works that were done in animals, but I'm not yet convinced of the values that are proposed. I think we must investigate it, especially if we consider the healing stage of the bone. My idea was to place the implant inside the rabbit's tibia, put loads with different degrees of strength and determine the limit acceptable by the implant. This was my first thesis article: I put a smooth implant, one loose and another tight. My idea, very simple, was to show that the loose implant would not osseointegrate; this would be the base of my other work, in which I would put different types of load on the implants that were loose. However, the

loose implant formed more bone than the other, which I understood as coagulation disorder, where the loose implant would generate more bleeding and, therefore, a larger osseous callus. By the same time, between 2003 and 2004, the nanotechnology was emerging in the area of material science, with some potential advantages for bone formation. Professor Ann Wennerberg had an amazing history of microstructure assessment. Then, talking, it came up the hypothesis of use nanostructure in this model developed in the first article, being the perfect model for placement of nanostructure and



Medical Center of the University of Rochester.



In this conglomerate of building is the population service and the laboratories of medical research. There are many services, such as pharmacies and optical stores for the employees.

evaluation of only its effects; for the stability was controlled independently of the surface. Anyway, the opportunity was a bit of luck: To be at the right time, in the right place, with the right model. At the same time, the evaluation of the implant's surface with atomic force that I developed was fundamental for my thesis, because with this analysis I could prove that nanostructure modifies the implant's surface, which nobody believed until then, simply because it was not visible to naked eyes. I proved that nanotopography changed and quantified each nanostructure. When you modify the microstructure, you can see; but the nano you cannot see to naked eyes. The struggle was to convince people. I showed my images and proved that there was alteration; it could be minor but there was. This was the great contribution: To characterize the nanostructure as I did and to prove it is related to topography, not only to chemistry.

### **How did you face us, Brazilians, watching your thesis defense?**

At first, when Tomas told me, I thought this could distract me and I asked to defend in a different date from your visit because I feared too much interference and increase of the natural stress of the moment. I had invited professor Lyndon Cooper, despite the Swedes had warned me that Americans are very aggressive accusers, much more than the Swedes, that treat

the moment more like a ceremony activity, not as a final test. But Lyndon Cooper said it was his son's birthday and he had promised not to miss this day anymore, thus, the dates ended up coinciding. So I convinced myself that there was no way and hoped there would not be any problems. It really was a great surprise, very nice people. Professor Elias was also there, whom I consider as living proof that genius and humility can be present in the same man. And the party afterward was great.

### **Tomas Albrektsson invited you to stay there as professor?**

It was Ann Wennerberg, who was from Prosthesis Department who invited me to stay as Research Assistant. I stayed for about two years.

### **How did you decide to go to Rochester?**

In the beginning it was not my idea to come here, but to stay in Gothenburg. But I decided to come for a greater project and lead my own laboratory. I think I was in a moment of my life that was moving towards this, to grow and be able to make the things I wanted. Despite my good relationship with everyone, I needed space to do my own things, and for that I had their total support.

### **Do you only work with Prosthesis or do you also do surgery?**

I work in the clinic with Prosthesis and make researches applied in different animal models.

### **Today you are professor of Prosthesis or of Biomaterials?**

I'm professor at the Faculty of Odontology, in the department of Prosthesis, and professor at the Faculty of Bioengineering. I work with biomaterials that are used for implants and for prosthesis. They are very close areas.

### **But your research is in the biomaterials area?**

Yes, I have a laboratory with interferometer, atomic

force microscope and all the equipment for histology. The same kind as they have in Sweden.

### **This way, it can be said that you have means to do research works in the same level as they do there?**

Yes, this was a condition that I required to the university because I was at a certain stage in life where I could not stop publishing, I needed to continue my work. Therefore, in order to leave and come here I needed at least the same conditions I had there.

### **If it were here in Brazil, you would have to appeal to CAPES or to CNPq to try sponsoring the appliances. What about in the U.S., how does it work? Is there fomentation from the government or is it private?**

There are both. Here there is a private university from the Ivy League, the American league for excellence in education. It is the greatest American private university of research. When they find a person with potential, they just go for it, here in the U.S. it works like this. If you come here to teach a class, stay for a week, research and show interest in staying and they identify potential in you, they will come for you.

### **How is it in the Rochester system? You teach, research, but also have time to practice?**

The American university is very efficient to give return both to the professional and to the institution. For example, when I came here they asked me how they could financially provide my arrival. I said I liked to make prosthesis, that I wanted to go back to practice because I missed it since I did not use to practice in Gothenburg. I wanted to have my own laboratory of research and that I could also work with students which would be important for the school. My time would be distributed according to this. The American superior education is going through a great change.



Rush Rhees Library, in the background, and the Interfaith Chapel, in the foreground.

Today every professional in the universities has to justify their incomes; so, when a person is hired by a university, they will want to distribute the schedule making it productive. You teach, instruct the students in practice, make literature review and research, but also work in private practice to generate revenue for the department.

### **Do you have students of master's degree and doctorate?**

I have one student of masters and one of doctorate, and I receive visitor students from many countries, from Brazil to Japan.

### **What are the results you already have from the new micro-nano surface from P.I. Brånemark Philosophy developed by you?**

This project started in 2009. We did many tests to reach ideal parameters. Several characteristics were observed. There are many things about which I cannot extend for they were not yet published, showing that besides the characteristics of topography and chemistry — which are very interesting — it has a characteristic of surface integrity that is unique. We need to have the surface intact through all the process. It is the same line of reasoning from 1999, when I had the idea of the initial project, of studying the interface behavior, given that the surface also have a good performance when submitted to load.

### **What is the meaning, for Brazil, of the surface you have created and the effect this could have on global market of implants?**

Brazil, today, is in growth phase, standing out in the whole world. But still lacks public and private investment on development of new ideas. The project of the new surface lasted many years and had investment from the company until the launching, with no immediate return. I accepted the job, believing we could make something innovator, instead of simply repeating what have already been used; a lower risk, but that would not bring anything new.

### **We have seen other countries investing in people for them to improve abroad and to return home bringing knowledge and technology to their nations. How do you see the Brazilian policy regarding this?**

I cannot put this as responsibility of the Education Ministry or the Science and Technology Ministry. I think they are not the appropriated organs because they have to focus on educating an enormous layer of the population on secondary and high school. It could



be a job for the organs of development such as Finep or investment funds to establish mechanism that provided laboratories of high technology in Brazil. Today, the partnerships are fundamental for the success of a project, but you cannot depend 100% on collaborators for your project to move on. A successful project depends on a great idea, adequate equipment and, of course, luck along the way.



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