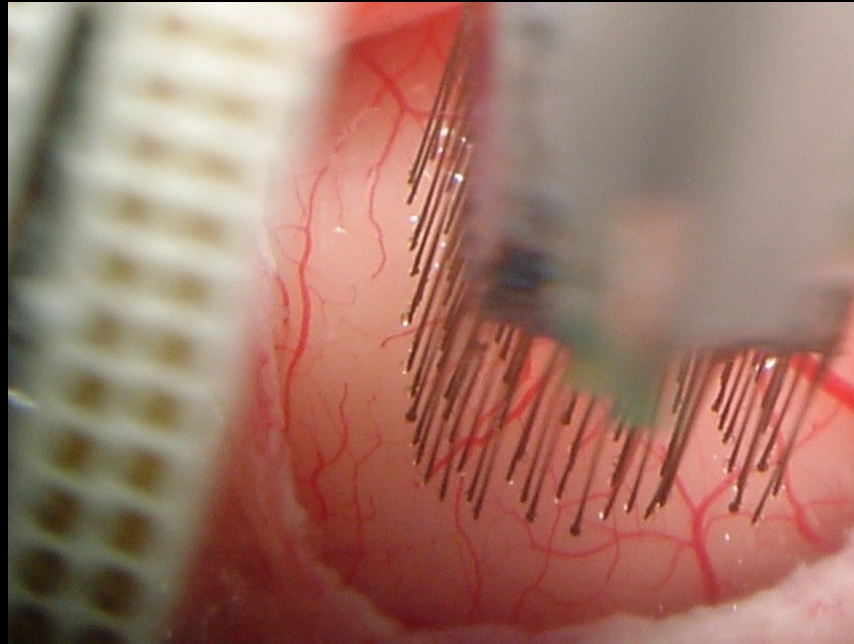


# Reflexões sobre o desenvolvimento em C&T do município do Natal: o caso da Neurociência



Sidarta Ribeiro



**IINN-ELS**  
INSTITUTO INTERNACIONAL  
DE NEUROCIÊNCIAS DE NATAL  
EDMOND E LILY SAFRA

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UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE



# IINN-ELS

INSTITUTO INTERNACIONAL  
DE NEUROCIÊNCIAS DE NATAL  
EDMOND E LILY SAFRA

## Parceiros:

Universidade Federal do Rio Grande do Norte (UFRN),  
Universidade Duke, Fundação Avina, Lily Safra,  
Governo Federal (MEC, MCT, MS, Finep, Capes,  
CNPq), Hospital Sírio Libanês, Fapern

## Sede:

Instituto Nacional de Ciência e Tecnologia em  
Interfaces Cérebro-Máquina (INCEMAQ)

## Cooperações Internacionais:

Argentina, Chile, EUA, Suíça



# Centro de Estudo e Pesquisa César Timo-Iaria

[www.natalneuro.org.br](http://www.natalneuro.org.br)





6 professores  
8 pós-doutorandos (5 atualmente)  
7 doutorandos  
12 mestrandos/residentes (8 atualmente)  
30 alunos de IC (12 atualmente)  
7 estudantes visitantes (graduação e pós)

**TOTAL 2005-2009: 70 pesquisadores**



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# Centro de Pesquisa - Macaíba



# Nos próximos anos:

Pesquisar terapia semi-invasiva para mal de Parkinson;



Desenvolver *hardware* e *software* para registrar e processar milhares de canais;

Criar novos algoritmos de análise para dados neurais massivos;

Criar interfaces cérebro-máquina não-invasivas em tempo real;

Acoplar aparatos de realidade virtual às interfaces cérebro-máquina.



Blue Gene vai morar em Macaíba...

Centro de Saúde Anita Garibaldi - Macaíba (20.000 pacientes/ano)





# Escola Alfredo Monteverde - Natal

600 estudantes



# Escola Alfredo Monteverde - Macaíba

400 estudantes







# Building a Future ON SCIENCE

Brazilian neuroscientist Miguel A. L. Nicolelis taps into the chatter of neural populations to drive robotic prosthetics. Now he hopes to tap the potential of his country's population by building them a network of science cities >>> **BY CHRISTINE SOARES**

In a tiny, darkened room on the Duke University campus, Miguel Nicolelis looks on approvingly while a pair of students monitors data streaming across computer screens. The brightly colored dashes and spikes reflect the real-time brain activity of a rhesus macaque named Clementine, who is walking at a leisurely pace on a little treadmill in the next room. Staticky pops coming from a speaker on a back wall are the amplified sound of one of her neurons firing. "This is the most beautiful music you can hear from the brain," Nicolelis declares with a smile.

The run-through is preparation for the next big demonstration of work toward mind-controlled human prosthetics that first garnered worldwide headlines for Nicolelis and his team in 2003. Back then, the group showed that they could listen in on brain signals generated by a monkey using a joystick to play a video game and translate that biological code into commands for a mechanical arm to perform the same motions. Now the group intends to make robotic legs walk under commands from the motor cortex of a monkey strolling along like Clementine. This time the scientists also want to feed sensor data from the robot feet into the monkey's brain, so she can "feel" the mechanical legs' strides as though they were her own. To raise the stakes still further, the monkey will be

at Duke in North Carolina, but the robotic legs will be half a world away at the Advanced Telecommunications Research Institute International in Kyoto, Japan.

The complexity of the experiment presents potential obstacles, Nicolelis admits, but satellite transmission delay of the signals traveling to and from Japan is no longer among them. One of the young men in the room, Ian Peikon, found a way to reduce the delay to a negligible 120 milliseconds. "And he's an *undergraduate*," Nicolelis adds, delighting in the opportunity to illustrate a favorite point—that you don't need a Ph.D. to participate meaningfully in science. The allusion is to a larger personal philosophy that has been driving the 46-year-old neuroscientist's pursuit over the past five years of a very different kind of ambition, perhaps on a par with uploading sensations to the human brain.

Convinced that science is a key capable of unlocking human potential well beyond the rigid hierarchies of academia—and outside the traditional scientific bastions of North America and Europe—his other big project has been nothing less than a quest to transform the way research is carried out in his native Brazil. In the process, he believes, science can also leverage economic and social transformation throughout the country.

The heart of Nicolelis's vision is a string of "science cities" built across Brazil's poorest re-

**SCIENCE IN A NOVEL SETTING:** The International Institute of Neuroscience of Natal (IINN) research facility in the city of Natal; IINN scientific director Sidarta Ribetiro observes a rodent's brain activity (top row). Students build electronics in IINN's Macaíba school; residents of the Natal area (middle row). Entrance to the IINN health clinic in Macaíba; neuroscientist Miguel A. L. Nicolelis at the IINN research building entrance in Macaíba (bottom row).

## KEY CONCEPTS

- A neuroscientist's plan to establish top-quality scientific institutes across Brazil is also a social experiment in distributing the intellectual and economic fruits of science.
- Global networking, heterogeneous funding and fortunate political timing have allowed the project to progress rapidly.
- The expatriate scientists who originated the plan hoped to help shape a competitive nation whose future citizens can excel without having to emigrate.

—The Editors



ALL PHOTOGRAPHS BY CYCERO BOLA, CORNELIA VIEIRA. EXCEPT FOR BOTTOM LEFT BY LUDWIG LANGE, SHINGA, PAVAN/REUTERS/GETTY IMAGES

Forum

# Brazil's Option for Science Education

A new nationwide plan to enfranchise all citizens through education will allow Brazil to reach its full potential

BY LUIZ INÁCIO LULA DA SILVA, FERNANDO HADDAD AND MIGUEL A. L. NICOLELIS



Less than a quarter of a century after emerging from a military dictatorship, Brazilians have built a stable and vibrant democracy in which more than 80 million voters freely decide the future of their beloved country in each and every election. Lately, by becoming a world leader in food production, spearheading the search for biofuels as a new source of renewable energy and seeking ways to grow its economy while still protecting its unique natural ecosystems, Brazil has started to address a broad range

of a network of 354 institutes dedicated to teaching science and technology to high schoolers and training thousands of new teachers in the public education system.

Inspired by the example set by Alberto Santos Dumont, the great Brazilian inventor and aviator, who in 1901 became the first man to fly a controllable airship powered by an engine, a group of Brazilian scientists decided in 2003 to establish, in the city of Natal, in the northeast of Brazil, a research institute dedicated to using the production of state-of-the-art science as an agent of social and economic transformation for one of the least

scientific-social initiative to launch the Alberto Santos Dumont Science Education Program for Children. The goal of this initiative is to enroll one million children from the public school system nationwide in the most comprehensive science and technology education program in Brazilian history.

so that all Brazilians can acquire the means to become creative and critical thinkers, capable of developing their own opinions and becoming true contributors to solve the challenges involved in constructing a fair and democratic society.

Three tenets serve as the main foundations of the Brazilian Plan for the Development of Education (PDE): systemic, territorial and empowering education. Enacted by the current administration, this plan outlines a broad range of executive measures aimed at rescuing the quality, reach and long-term impact of the Brazilian education system.

In addition to promoting actions to improve the basic training of teachers, to establish a national evaluation system, and to define the basis for a close collaboration between the federal government and the states and municipal authorities, the PDE provides, from its fourth year on, an extra 19 billion reais (US \$10,633,535,000) earmarked for education.

The PDE also enacts new directives and guidelines for the creation of the Federal Institutes for Education, Science and Technology (IFET in Portuguese), which will result in the establish-

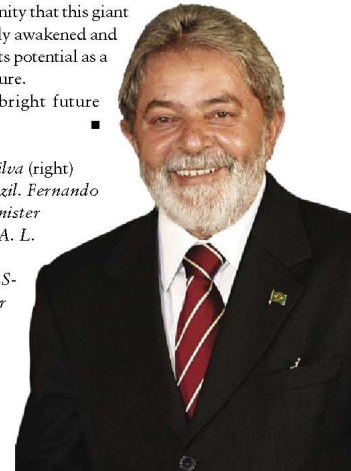
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science education in particular throughout its entire territory, Brazil is sending a loud message to its citizens and the global community that this giant of the tropics has finally awakened and is now ready to fulfill its potential as a true country of the future.

For Brazilians, a bright future starts now.

*Luiz Inácio Lula da Silva (right) is the president of Brazil. Fernando Haddad is Brazil's minister of education. Miguel A. L. Nicolelis is scientific coordinator of the ELS-IINN, and co-director of the Center for Neuroengineering at Duke University.*



PHOTOGRAPH BY ERALDO FEELSAZ/AF PHOTOS; ILLUSTRATION BY MATT COLLINS