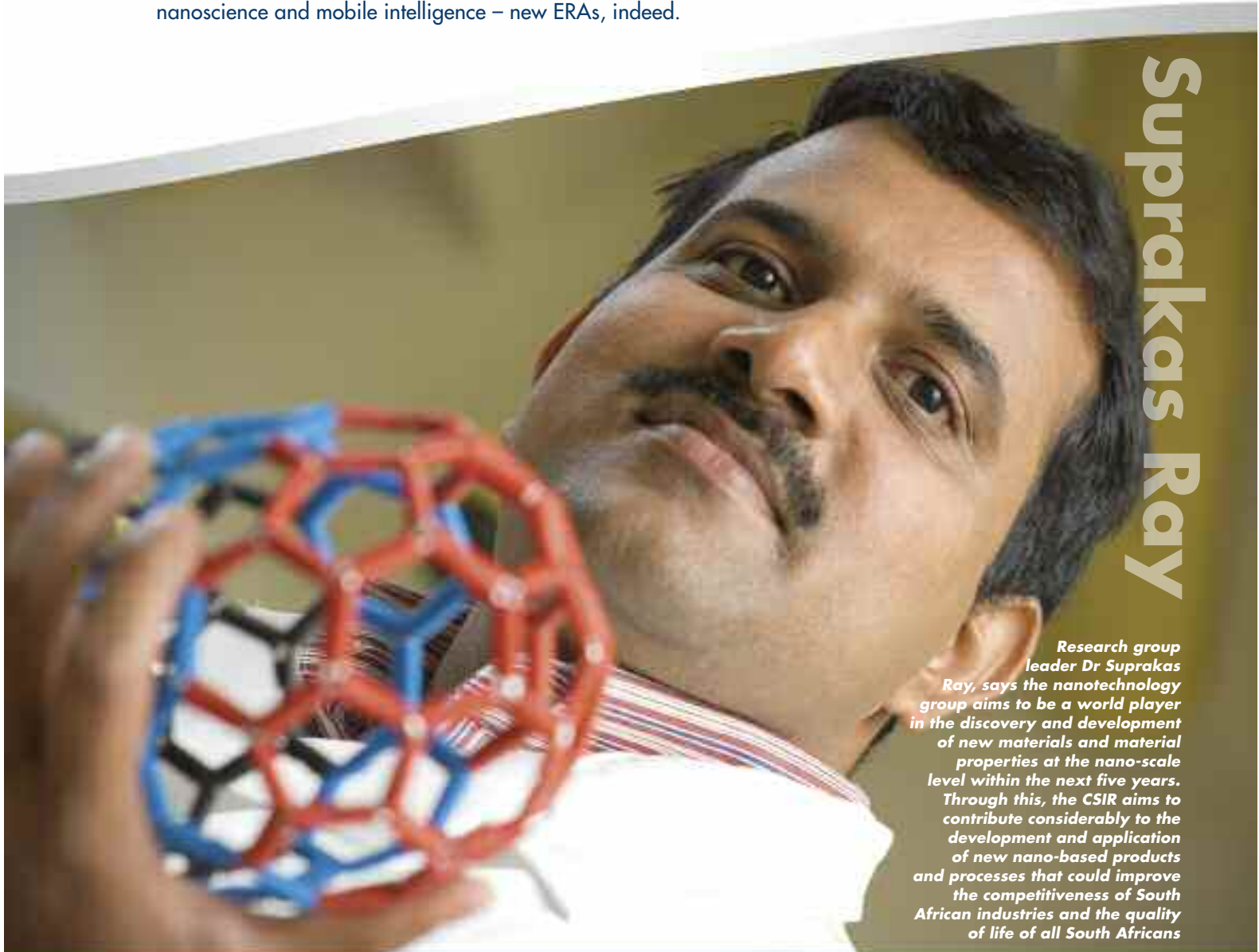


# Emerging Research Areas

EMERGING RESEARCH AREAS (ERAs) are new areas of science that the CSIR deems important to pursue. These typically require a significant investment in developing or recruiting scarce skills with a view to build a national science capacity. New areas include artificial intelligence, bio-engineering technologies, nanotechnology, environmental informatics, human language technologies, modelling, prediction and optimisation technologies, opto-electronics/ photonics, pharma and nutrigenomics and sensor technologies. In this edition, *ScienceScope* features the fields of nanoscience and mobile intelligence – new ERAs, indeed.



Suprakas Ray

*Research group leader Dr Suprakas Ray, says the nanotechnology group aims to be a world player in the discovery and development of new materials and material properties at the nano-scale level within the next five years. Through this, the CSIR aims to contribute considerably to the development and application of new nano-based products and processes that could improve the competitiveness of South African industries and the quality of life of all South Africans*



# Pumeza Ceza

## Translating science in a free and open environment

**Open source software (OSS) refers to software that is developed, tested, or improved through public collaboration and distributed with the intention that it must be shared with others, ensuring further collaboration. Pumeza Ceza is a young CSIR professional who works at the coalface of new developments in this field.**

PRESIDENT THABO MBEKI'S famous "I am an African" speech captures who Pumeza Ceza is. This young and outspoken advocate for open source software (OSS) hails from the little rural town of Ku-Gatyane on the Wild Coast, Eastern Cape.

In his speech, the President said: "I am an African, I owe my being to the valleys, the mountains and the glades, the rivers, the deserts, the trees, the flowers, the seas and the ever-changing seasons that define the face of our native land."

Working in an information and communication technology (ICT) arena has been a

highlight for Pumeza Ceza of the CSIR's Meraka Institute Open Source Centre.

The bubbly Pumeza's early dreams had nothing to do with working in the ICT arena. She wanted to become a television personality. As a result, she pursued social science subjects at school. "Mathematics was my worst nightmare," she recalls. When she packed her bags, leaving her family and friends behind for the University of Fort Hare in 1997, little did she know she would end up in a science-driven industry, let alone working on OSS instead of making a name for herself as a journalist or a communication professional.

After obtaining her Bachelor's in social science, specialising in communication, she became a freelance journalist and her articles appeared in national newspapers and magazines. Pumeza decided to leave journalism to pursue other avenues, which later landed her the job at the CSIR.

**“When I first joined the CSIR, it was easy for me to find my way in an OSS environment. OSS has a social aspect to it, which makes this environment the best place for me to apply it.”**

Since joining the Institute, the 26-year-old OpenSpeak researcher, has made a significant contribution to the popularisation of OSS as well as to international research and collaboration on such projects. The CSIR announced at the beginning of the year that it had adopted the open document format (ODF) as its default document format as part of the organisation’s move to free and open source software.

“I find open source amazing, it is very accommodating to people like me who know less about the technical aspects of ICT,” she says. “When I first joined the CSIR, it was easy for me to find my way in an OSS environment. OSS has a social aspect to it, which makes this environment the best place for me to apply it.”

The Meraka’s Open Source Centre boasts a successful Soweto satellite office, which for Pumeza translates to ICT being about people development and transformation. She says the Soweto office is in line with a UN-funded initiative to extend the reach of open source benefits to regions in the continent where the software has not yet made an impact. A similar endeavour is at the i-Community centre in the Mokgalakwena district of Limpopo. Through these satellite offices, the aim is to foster networks of open source specialists capable of sharing their expertise with the community.

Pumeza is currently working on the Linux Professional Institute (LPI) certification project, of which the Meraka Institute is a master affiliate. She says that LPI certification is a step in the right direction for the country in efforts to produce more open source qualifications.

“My responsibilities include drafting the LPI certification marketing plan; liaising with the LPI headquarters in Toronto; establishing networks with the technical media; and networking with LPI training institutions, government and tertiary institutions.”

The Meraka Institute will facilitate LPI exams throughout the country. LPI training institutions will train the candidates and send them to the Meraka Institute for exams, which will guarantee them certificates and possibly a job thereafter. “We work with government departments, as they employ a large pool of technologists for numerous IT systems. LPI certification will earn South African ICT global recognition,” she enthuses.

“I like open source because it caters for community development, unlike proprietary software and its limitations, also in terms of cost. Open source puts software within financial reach, while also allowing creativity: users can amend and edit open source systems and use them for their own work.”

Although Pumeza does not have a science or an engineering background, she has managed to fit in at the Meraka Institute, where the speak is computer-based and technical. “I have discovered that there is a relationship between engineering and social sciences, which makes for very interesting subject matter,” says Pumeza.

“It is exciting to work in an environment where I have become a witness to transformation and development in the country. It is fulfilling to see that South Africa is working towards reaching the Millennium Development Goals,” she says.

Pumeza is currently working towards an Honours degree in social science through the University of South Africa.

She is young and bright, and not at a loss for words when it comes to describing herself and her profession. “Most of the time, boffins battle to express themselves; they are innovators with great inventions, but someone has to translate the implications of their work and advocate the benefits of what they do. That’s me,” she concludes.

**– Mzimasi Gcukumana**

**Pumeza Ceza, OpenSpeak researcher, takes a moment to consult a FLOSS manual**



# Understanding and controlling the basic building blocks

*Dr Suprakas Ray left a promising career in Canada, and turned down an attractive offer from Japan, to move his family to South Africa – all because he realised the country's immense potential in the booming nano-structured world market.*



"NANOTECHNOLOGY RESEARCH is leading to an unprecedented understanding of and control over the basic building blocks and properties of all natural and man-made objects," says Suprakas, the research group leader and chief researcher of the newly established National Centre for Nano-Structured Materials at the CSIR in Pretoria.

## New devices and processes

Over the past few years, nanotechnology has radically changed the fields of physical sciences and engineering, somewhat comparable to the emergence of superconductivity in 1986. It encompasses not only physics, chemistry, materials science and engineering, but also biology and medicine. In addition to an understanding of and control over the basic building blocks and properties of objects, advances in nanofabrication – using top-down as well as bottom-up technologies – make it possible to work at the atomic and molecular levels to create large structures with fundamentally new functionalities.

"Beyond the scope of our current conception, perhaps 30 to 40 years ahead, completely new forms of devices and processes will emerge," Suprakas says.

## Research focus

When the Department of Science and Technology (DST) launched the National Nanotechnology Strategy (NNS) in April 2006, it invited the CSIR into the fold. This initiative and subsequent strategy and implementation plan led to the establishment of the new nano-focused centre in early 2007.

The following research focus areas have been identified for the centre, based on trends and developments, the existing science and technology strengths in the CSIR and the need to align with and support the NSS:

- Fabrication of novel nanostructured materials
- Synthesis and characterisation of quantum dots
- Synthesis of polymer nanocomposites
- Application of nanostructured materials in the energy sector.

*"Nanotechnology research is leading to an unprecedented understanding of and control over the basic building blocks and properties of all natural and man-made objects."*

## Materials modelling and simulation

Initial research will be on the fabrication of new and novel nanoparticles, such as carbon nanotubes, nanosilica, nano-titanium dioxide, platinum nanorods and boron nitride. Other focus areas include the synthesis and characterisation of nanocrystalline materials, i.e. quantum dots, and the preparation of next generation high-performance structural and functional polymer nanocomposite materials. The group will also collaborate with other CSIR research groups, universities, science councils, the private and public sectors and international research institutions.

## Future plans

Prior to the official establishment of the centre for nanoresearch, the CSIR already invested significantly in nanoscience and technology laboratories and instrumentation, and established the nanoscience research group as part of the organisation's emerging research areas (ERA) initiative.

"This country is brimming with promising scientists; when we advertised for the first 20 new positions at the Centre, we received 163 deserving applications."

## The ideal research leader

Suprakas joined the CSIR in October 2006. Born in India, he completed his PhD in physical chemistry (polymer science) at the University of Calcutta in 2001, while working in Canada. After three years in north America, he was awarded the prestigious JSPS Postdoctoral Fellowship from the Japanese government and moved to Japan as a postdoctoral fellow and research scientist, focusing on nano. Within three years, his *alma mater* in Canada lured him back by awarding him the Canada Research Chair Postdoctoral Fellowship (research scientists) on polymer physics and nanomaterials. His task was to start a nanoresearch group at the Laval University in Quebec.



**Dr Suprakas Ray (middle, in front) with some of his PhD students. From left are Bonex Mwakikunga, Matete Mashapa, Thabo Gcwabaza, Siphon Mavundla, Nobanathi Maxakato, Mamookho Makhatha, Patrick Sibaya, Joseph Hato and James Ramontja**

It is expected that within the initial three years of its existence, the centre will generate important new knowledge relating to nanoparticles, quantum dots and nanocomposites. "This knowledge will have application in a number of diverse areas of importance to the South African manufacturing industries," Suprakas says.

"Our 10-year vision is to be a leading research institute in the world for research and innovation into nanotechnology-based solutions addressing the specific needs of developing countries," he says.

The centre has 12 PhD students, all from South Africa or Africa, and Suprakas is study leader for six of them. Nine more PhD students will join the current staff complement of 23 in the second half of 2007, including students from Canada and India. "All of them are excited; South Africa is a land of opportunity for scientists," Suprakas smiles.

He applied for the position at the CSIR on the spur of the moment, Suprakas recalls. After a lengthy telephonic interview, he was invited to the CSIR for a two-day visit and another set of interviews. It was his first visit to this country. "I am truly fortunate that I was appointed in this position," he says. "The CSIR is a great place to do science, it has such a conducive environment and I get so much encouragement from my peers."

## Human capital development (HCD)

One of the key strategies of the centre is to act as a national resource for MSc and PhD students to perform innovative research on nanostructured materials under the supervision of experienced researchers. Specific components of the HCD strategy and plans include appointing, on a temporary basis, 25-30 MSc and PhD students (at least 80% of whom will be black and 40% female) by 2008, and ensuring their successful graduation.

**– Renatè Janse van Vuuren**