

June 6, 2008

By: Alice Ward

Some people think it has to do with being born to the right set of parents. Some believe it hinges on that first moment of inspiration or the guidance of a brilliant mentor. In the case of Rajan Chakrabarty, when asked what inspired him to go into the field of science research, he mentioned a little of everything...

“Being born to highly educated parents in India, the zeal to pursue higher education was instilled in me right from my childhood days. But the thought of pursuing a career in science never happened to me until my undergraduate days back in India. It was during my undergrad years when I came in personal touch with one of India’s prominent thinkers and philosophers, Sri Atmananda. I consider my acquaintance with him during my formative years as the turning point in my life. My observation of him investigating into every aspect of his daily life in minute details helped open up the “investigative” nature in me without my knowledge. Further, it was he who inspired me to come to U.S. and shift fields from engineering to sciences. Hence, whatever little I have been able to contribute in the field of scientific research so far, I owe it to his influence on me.”

As Rajan completes his graduate degree at UNR, he is receiving one of the University of Nevada Reno’s most exciting awards. Every year, UNR holds an ‘Honor the Best’ Ceremony at which students and faculty members are recognized for their excellence. Rajan Chakrabarty was recognized as ***Outstanding Graduate Student Researcher***. Upon completion of his doctoral degree in the Chemical Physics at the University of Nevada Reno, Rajan hopes to obtain a research position at DRI or UNR and as a recent recipient of this very prestigious award at UNR, the possibilities are endless.

The Nevada NSF EPSCoR leadership is happy to have supported Rajan’s research through two merit-based competitions. As the year comes to an end, Rajan is wrapping up a two year Cognitive Information Processing (CIP) fellowship that was awarded to him through the Nevada NSF EPSCoR RT II award as well as a CIP entrepreneurial award.

He received both awards through highly competitive processes through the Cognitive Information Processing (CIP) component which was lead by Dr. Sushil Louis of UNR. Please see their website information at: <http://www.cse.unr.edu/~cip/>. The vision of the Cognitive Information Processing Program has been to stimulate collaboration among faculty researchers and with graduate Fellows to form nationally competitive interdisciplinary teams to develop tools and techniques for building computational systems that sense the world, construct valid models from sensed information, and act on the basis of these induced models and current sensor values.

As part of the fellowship program, each CIP Graduate Fellow has worked with two or more NSHE faculty mentors in Nevada with expertise in different aspects of cognitive information processing. Rajan was mentored by both Dr. William Patrick Arnott of UNR and Dr. Hans Moosmuller of the Desert Research Institute.

On the funded entrepreneurial project, Rajan is currently working with a team of student researchers mentored by Dr. Moosmuller. The goal of this program has been to enhance the entrepreneurial climate in Nevada by stimulating student entrepreneurship and to act as a magnet for technology corporations and skilled personnel. To achieve this goal, the Nevada NSF EPSCoR program provided initial support to bring an innovative product or technology from idea to prototype and open the way to successful commercialization. Undergraduate and graduate student teams of two to five under the mentorship of NSHE faculty members competed for these \$5000 awards.

When asked to describe his NSF EPSCoR project in layman's terms, Rajan Chakrabarty explained the following...

“In layman's terms, my NSF EPSCoR project involved investigation into the optical and microphysical properties of fractal-like aerosol and nanoparticles. Short descriptions of the various segments of the research conducted so far under this fellowship are:

1) Improved understanding of the aerosol radiative properties in conjunction with the global climate change puzzle

Carbonaceous aerosols constitute a dominant fraction of particles residing in the earth's troposphere. Their presence in the atmosphere influences the earth's radiation balance and climate, atmospheric chemistry, visibility, and the health of living beings including humans. Quantifying the optical properties of carbonaceous particles has always been a great challenge mainly because of their complex particle morphology. Using Fractal mathematics, I compared experimental light scattering data with different light scattering theories currently used in various global climate models. The results obtained from this research will greatly help in the understanding of the optical properties of fractal-like aerosols and help integrate them into the radiative transfer components of global and regional climate models.

2) Engineering of microphysical properties of nano-particles

We invented a patent-pending, charge-based technique that accomplishes nano-particle segregation based on morphology. This technique was tested on flame-generated soot aerosols where singly and doubly net-charged nano-particles of similar sizes were segregated using electrostatic classifiers and were shown to have different morphologies. This simple technique has the potential for immediate application in the material subfields of pharmaceuticals, nanopowder synthesis, and carbon nanotube production.

3) Modeling and simulation of nano-particles and particle-forming processes

The modeling of nano-particle formation represents a continuing challenge in particle technology. We have recently developed a patent-pending aerosol simulation package, *FracMAP*, which simulates 3-dimensional (3-d) quasi-fractal agglomerates and creates their 2-dimensional (2-d) pixelated projection images by restricting them to stable orientations as commonly encountered for quasi-fractal agglomerates collected on filter media for electron microscopy. The package also enables to calculate the fractal dimensions and other structural projection properties of the agglomerates, the knowledge of which will help experimentalists in extracting 3-d structural information from 2-d images of real aerosol particles.”

Rajan noted, “From the entrepreneurial side, I would want to take the two startups to the next level in the next year or two. The first startup, Isotome.com (a web 2.0 educational company), is all about improving the current education systems in high schools and colleges through the uses of internet-based education technologies and computer-based modelling/simulation tools. We have recently partnered up with an international software firm in Reno, Cyhite Corporation, who works directly with Google. We plan on launching our product this summer in universities and high schools all across the U.S. The second startup, Sierra Particle Technologies (a nano-tech spin-off from the aerosol research group at DRI and Harvard) has caught the attention of giant corporations like FEI and Cabot in terms of partnering with us.”

In summing up his research experiences in Nevada, Rajan reflected...

“The 2 year NSF EPSCoR fellowship, besides other impacts, has been instrumental in shaping my mindset to work as an independent researcher very early in my scientific career. It has contributed tremendously to the development of strong interdisciplinary scientific skills in me which are quintessential for the making of an independent and reflexive researcher. My proposal to the 2 year CIP program discussed development of new technologies/approaches in the fields of aerosol and combustion science. At the time of writing the proposal to the NSF EPSCoR program in early 2006, most of my proposed technologies in the proposal were in the “hypothesis” stage yet to be fully realized. And after I was awarded the fellowship, I was pretty much on my own to deliver the goods promised in the proposal. This was a very new experience for me as in the previous years I was always working for people on projects which revolved around their ideas and not mine. In other words, this time I was sitting on the “captain’s seat” to steer my PhD research on my own. Of course, my advisor, Prof. Hans Moosmuller, was always there to help me out in every step of my grad journey. But he always saw to it that he never “spoon fed” me and always left the major decisions regarding my research to be made by me, be it wrong or right. I guess this has always been his approach with most of his graduate students in the past. He sees one’s doctoral tenure as an opportunity to groom oneself with all the skills necessary for one to survive in today’s research arena professionally. From the very beginning, he always used to tell me that today’s science no longer exists in the vacuum as was the case in the past, and that one has to hone oneself with excellent communication and independent-thinking skills in order to succeed. This approach of his coupled with the financial support from the NSF EPSCoR has made me a responsible researcher and person, in my opinion. This 2 year funding period has provided me with ample time and opportunities to learn from the mistakes which I have made as a researcher, and at the same time helped me to clearly identify my strengths and weaknesses and work on them. On another level, it has also partially helped me to identify the “entrepreneurial” spirit inside of me, which resulted in me co-founding two technical start-up companies in the past one and a half year in Reno. Lastly, this funding has also enabled me to travel to conferences/workshops/meeting and present my research to the scientific community. This has helped me to make acquaintances with pioneers in my research field, and collaborate with them. “

When asked what his future plans were, Rajan responded...

“I plan to graduate during the fall of this year with a doctoral degree in Chemical Physics. As of now, I plan to hang on with Dr. Moosmuller’s research group at DRI, Reno for a year or two – the reasons being, 1) I plan on further developing the science/technologies taken up during my doctoral tenure, and 2) Maturing the two technical companies which I have co-founded – a) Sierra Particle Technologies (SPT), a nano-tech startup , founded by Dr. Moosmuller, Mark Garro (Harvard University) and myself, and b) Isotome.com, an educational web 2.0 startup company, founded by 3 Harvard students and myself. “

Regardless of the continuing debate of “nature versus nurture,” it is apparent that success comes to those who are willing to strive for excellence refusing to be defeated by circumstance. Understanding may come to those who ask “why?” Success often comes to those who ask “why not?”