

Undergraduate Research & Creative Activities (URECA)

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Ricky Chachra

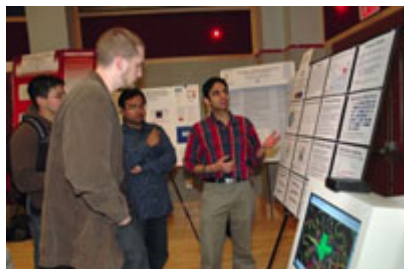
Applied Mathematics & Statistics MAJOR, Class of 07;
Howard Hughes Medical Institute (HHMI) &
URECA Summer Undergraduate Research Programs, 2006

Research Mentor: Dr. Robert Rizzo,
Applied Mathematics & Statistics

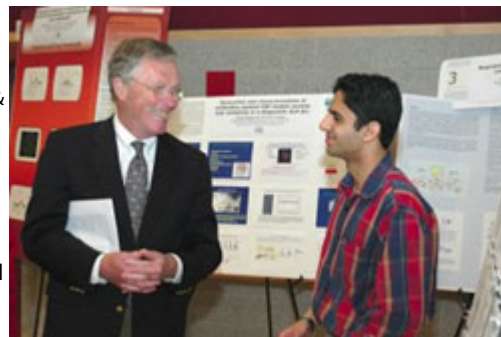
Researcher of the Month - September 2006

About Ricky

Much of the buzz around last spring's URECA [Celebration](#) centered around the "bird flu guy", Ricky Chachra. None were immune to Ricky's infectious enthusiasm, as students, faculty and senior administrators alike tried on the 3-D glasses, and became drawn into Ricky's engaged & energetic discussion of his research project: "Using computational methods to quantify binding of known drugs with strains of avian influenza (H5N1) to improve methods for rational drug design."



Since transferring to Stony Brook from Dowling College in Fall 05, and changing his major four times in his undergraduate years to date, Ricky has most definitely found his niche, working since October 2005 in the research group of Professor [Robert Rizzo](#) in the department of [Applied Mathematics & Statistics](#). Ricky has presented posters highlighting this work not only at the URECA research "[Celebration](#)", but also more recently at the Joint Stony Brook/BNL Workshop on Computational Biology (June 2006) held on campus, and at the [New York Structural Biology Group](#) Meeting held at [Cold Spring Harbor Laboratory](#) (July 2006). He also enjoys interacting with younger students and had a blast this past August co-teaching a [LIGASE](#)-run workshop (August 2006) with his mentor, Professor Rizzo, to middle and high school students: as Ricky helped with the simulations/demonstrations, they too could not help but respond to Ricky's enthusiasm, humor and passion for research!



Such positive energy - and caliber of work - does not go unnoticed. This year alone, Ricky Chachra has received the URECA summer research award, the Howard Hughes Medical Institute academic year research fellowship, the Sigma Xi Excellence in Research Award; as well as several scholarships, including the Robert & Katherine B. Frey Applied Math & Statistics Scholarship (2006-07), and the Srivastav, Tucker and Weitzman Undergraduate Applied Math & Statistics Scholarship (2006-2007); in 2004-2005, he received Dowling College's Presidential Award (full tuition scholarship). He is currently working on a manuscript (soon to be submitted) with his mentor, to whom he is deeply indebted: "Yes, definitely, that's been the best thing, working with Dr. Rizzo. He's *very very* supportive. He makes sure he takes his time and explains everything at very fundamental levels.. There've been so many opportunities . . . He really trusts me and relies on me with a lot of different things. I think we make an excellent team. It's an honor to be working with him."

Ricky also speaks only in superlatives when it comes to his favorite department at Stony Brook. "I think Applied Mathematics is one of the best departments in SB! And I completely admire each and every faculty member whose course I've taken in applied mathematics.—Dr. Joseph Mitchell, Dr. Alan Tucker. . ."

Born and raised in India, and an avid science student all through his secondary school years at St. Gabriel's Academy in Roorkee, Ricky Chachra has continued to develop and explore a wide variety of interests, and to make the most of opportunities while studying in Long Island. Following graduation in May 2007, he has plans to go to graduate school next fall, and to continue working in the field of computational structural biology. Of Stony Brook University, Ricky reflects: "Given how much I want to explore and find new things, I think Stony Brook was the perfect option for me. I'd been to Stony Brook several times and was very impressed." Below are some excerpts shared from his interview with Karen Kernan, [URECA](#) Director .

The Interview

Karen: What kind of research do you do? How did you first get involved?

Ricky: So in my previous school, I was working with [Prof. Herbert Bernstein](#) who is a professor in mathematics and computer science in Dowling College. He has a lab by the name of Accessible Retired Computers in Biology (called the [ARCIB lab](#)). He has several projects funded by the National Science Foundation, by the Department of Energy and by the International Union of Crystallography. I started working with Dr. Bernstein in the very first week I started college. And that was a very, very nice experience. I learned so much. I was just an incoming freshman. I had no clue about how to do things for the first time—what scientific research is like, what it takes. Dr. Bernstein has been an excellent mentor. He's a very very good scientist, a very eminent computer scientist, an icon of bioinformatics. And that was where my first introduction to structural biology was because his funds are mostly for bioinformatics-related projects. With that background, I found the transition coming into Dr. Rizzo's lab fairly easy. Because in Dr. Rizzo's lab, the projects are molecular recognition using computational methods. So the most general words that describe Dr. Rizzo's work — encompassing all the projects that there are — are "molecular recognition using computational methods." Some people call it computational structural biology. Computational structural biology is the bigger umbrella for it.

What can you tell me specifically about your current project?

There've been two projects I've been working on. The very first day I started it was with a program known as DOCK. DOCK was developed originally by the University of California at San Francisco. Dr Rizzo's lab is one of the official DOCK- developing teams of which there are a few around the United States...For improvement of DOCK, you constantly need to improve the scoring functions. With Dr. Rizzo [and his group], we've made one of the largest test sets for DOCK out there. We constantly use it, change it, update it, add more systems to the test set so that we can test the improved scoring methods and make it faster, make it more robust, more reliable so that better binding drugs can be found and developed accordingly. That was the first project. The second one is something I was interested in because of the rapid spread of avian flu. The second project has to do with making models for how drugs will bind to various strains of avian influenza. We are using computational methods to find how a drug will work against that target. So using molecular dynamic simulations, and MM-GBSA (that's the molecular mechanics generalized bron surface area methods) we can calculate how well they bind to the given proteins that are found on the avian influenza virus. The particular one I'm interested in is called neuraminidase. When you see H5N1, H5 is a protein and N1 is a protein.

How did you first find your mentor, Professor Rizzo?

I was going through the Applied Mathematics corridors, when I was a new student just exploring the Mathematics tower. So I walked across the gallery and found a nice poster and notices of research that his group has been involved in. I stopped there and I spent *at least* one and a half hours there, just reading, trying to understand what they were doing, how they were using computational methods. Given my background (through the ARCIB lab), I had the vocabulary. I was able to understand that project and how they were going about it. *And I got completely interested!* I sent Prof. Rizzo an email right away to see if there were any openings for undergraduates, or any opportunities for undergrads. Dr. Rizzo's response was very very encouraging. Just after one meeting with him, I had a place in the lab and I was immediately given a project to work with. He's been supportive from the very start. Part of the reason that I'm so interested in this field and this area is because of his support and his enthusiasm even with an undergraduate like me. I've been able, I hope, to contribute to the lab.

I think I'm very fortunate that I was able in the manner that I was able to find something that I really like [but] it took time. Since I started college, in just 2 years I've changed my major 4 times. I started out with mechanical engineering. Then switched to computer science, then switched to economics, then to applied mathematics. . . Science has always been at the core of the work that I'm interested in. But structural biology using computation methods [is] something that suits my interests and my aptitudes the best.

You presented two posters based on the work you did with Prof. Rizzo's group at our last URECA Celebration. Have you since gone on to present at other regional meetings?

[The URECA Celebration], that was my first time presenting, and it turned out to be very very good. In Dr. Rizzo's word, I made "quite a splash." So I was particularly happy with the response I got from the Provost and from the President and the other members of the faculty and staff who were there.

The workshop conducted jointly by SBU and BNL was a computational biology symposium. Various groups from SBU campus and BNL had come to give talks about their work. The field is so interdisciplinary. There is physics, mathematics, biology, biochemistry, chemistry, did I say mathematics? computer science, pharmacology. A computational biology group can be in any of these departments inside a university. . . so that workshop was really helpful!

The meeting at Cold Spring Harbor was the New York Structural Biology Discussion Group's meeting. They are one of the most fantastic discussion groups. They have a meeting in Cold Spring Harbor every summer, and a fantastic beach barbecue!. There were groups from lots of big places in NY, big name people. There was so much work that either directly or indirectly relates to my work, so I got to have a nice experience there. One of the faculty members from Stony Brook, Professor [Carlos Simmerling](#), presented. His talk was very very closely related to the work that I'm doing. He's the official developer for a program known as AMBER that we use for molecular dynamic simulations. His talk was related to research that he published along with Dr. Rizzo. That was a very interesting talk to listen to. I'm sure lots of people got excited with his talk in the area of computation modeling. The other very interesting talk I found [was given by] a presenter from Merck. She was talking about how her team was able to use computational methods to design a drug used for diabetes.

Do you ever find it difficult to balance academics with research?

Sometimes it's difficult to strike a balance. But research is also academics I think. And all the courses that I've been taking, almost everything since last year in Stony Brook has been directly or indirectly related to my research. There've been courses in applied mathematics. . . I've taken a course in biology. These [courses] give me more vocabulary to work with. Having those tools gives me a lot of confidence, gives me more options to be working with.

You have such enthusiasm for what you do, with everything! What advice would you offer to other students?

I think it's different for everyone. You really have to find something that you like. Part of the problem is exploring things. If you find something you really like, then half the problem is solved. You also have to keep in mind what your aptitudes are, how to be able to use those in the best possible manner in the field that you're interested in. My other advice is to take the initiative. Research is not going to come to them. They have to take the initiative, find out more, explore more.

You were funded through the URECA summer program this past summer to do full-time research. Is it a significantly different experience doing research in the summer than during the academic year?

Summer is an excellent time. It's the time when I consider myself to be most productive, and have the most focus with the task at hand. This is just my second summer. I was doing research full time [too] in my first summer of college when I wasn't taking classes. Actually [doing summer research turns out to be] more than full time, 150% more than full time when doing a 6 credit or a 3 credit course. And doing a full day of research, you *definitely* get lots more done! You are focused, there is nothing else to worry about. During the academic year, there is a quiz coming every week or so. Sometimes there are lots and lots of quizzes. Midterms, finals, other things. . . they are like speedbumps in the research.

What's the most frustrating thing you find about research?

It just takes time to understand something. It takes a *lot* of time. I always [used to] get told by my mom, by other people, how impatient I am. But I think this being-impatient-reputation [isn't so accurate now]. Because I like research-work so much—even though it takes time and understanding. I'm happy to spend that time.

Do you have any particular story/favorite research experience you'd like to share?

There was this time when we were stuck [on the avian influenza project]. We needed this crystallographic information for a protein that we wanted to work on....avian influenza...but that particular protein was missing from the data banks. No one had crystallized it so far. A scientist had made a model that was not publicly available and was due to come out in another 6 months. We were stuck at that point. But then Dr. Rizzo introduced me to a new computational method called homology modeling. It wasn't something that I was aware of before but then I learned that method. Using that, I was able to make a model for the protein that turned out to be a very good model, a very stable model that was observed later on in the simulation. Just going about making the model made me learn so many different things about viruses, about viral protein sequences, how you align those sequences, how you optimize parameters. In terms of different research, the fact that we were able to make that model. that was one of the most exciting days that I had! That happened just a few weeks before the URECA Celebration. Our simulations can take a very very long time. But the modeling was very exciting. We overcame that problem that the crystallographic information wasn't available. The fact that I was able to present my work. . . that's probably been the best story of my research so far.

How has the research prepared you for the future?

Research is a phase, a transition from undergraduate to graduate school. I think people have it backwards. When they do research, the next [obvious] step is to go to graduate school. Research prepares you for graduate school, but. . . I wouldn't get involved in research just because I wanted to go to graduate school. *I'd only do research because it interests me and it's something I like.* Maybe it's selfish. . . but I wouldn't put in the time, not even even 1% of the time, if I weren't interested.