

Reflections on a life of unexpected opportunities

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Surajit Sen asked me to write something personal about myself – my passions, influences in my life, and what drives my work in science and HIV/AIDS education. That is a very tall order and I have procrastinated for a year. In the end I decided to share events in my life that I consider significant and transformational.

There is nothing remarkable that I can recall about the first sixteen years of my life growing up in India. I was good in studies and sports with an aptitude for mathematics and the sciences. I loved to read, asked a million questions, and at the same time I was rebellious and irreverent. My father wanted me to be an engineer and I dreamed of being a scientist, but for no well-defined reason other than that was where solid answers lay and dreamers dwelled. At the end of high school in 1970 I did what all science oriented students in India did and do – sat for the Science Talent Scholarship and the IIT entrance examinations. Luckily, I got selected for both, but curiously neither meant much to me. I wanted to do physics honors at St. Stephen's College, again for no particularly good reason other than it was the most prestigious college in Northern India. In those days its reputation was based on attracting the best students from Northern India, having very good departments in arts and economics, and providing a very disproportionate number of successful candidates for Indian Administrative and Foreign Services. The year 1970 was the first year in which honors courses in Physics and Chemistry were taught in the colleges affiliated with the university so there was no history or reputation to go by in choosing Stephens.

In retrospect the decision of which path to choose was made hastily. In between the brief walk between the IIT interview and course allocation (Electronics in IIT Kanpur) and the office where the registration fee was being collected I made my decision. I wanted to go to St. Stephens. I did not register for the IIT, thus giving up my IIT position without having secured admission into St. Stephens. The results of their admissions would not be announced for another few weeks. You can well imagine my father's reaction! Fortunately, I did get admission to physics honours course in Stephens.

The three undergraduate years are best forgotten in terms of learning. Sports and the distractions of living in a dorm with essentially complete freedom kept life interesting and fun but with little academic development. Fortunately, two teachers sustained my interest in physics. Dr. Popli was an exceptionally kind and unpretentious individual who was completely dedicated to science and teaching. He, and to lesser degree Dr. Bhatia, continued to expose me to the beauty, precision and the logic and definiteness of science and mathematics.

The two years of the Master's program were much better spent. By then I had decided to focus on academics, wanted to do research in particle physics and had started to work hard. During those two years I felt I learned a lot, however, in retrospect it was an illusion. The learning was mostly training the memory as we were not asked to, nor expected to, solve any problems. We just had to know how to regurgitate what had been

said in class and prepare and memorize extensive answers to canned questions that appeared with some regularity over the years (a real-life Monte Carlo simulation). There was little emphasis on how to apply classroom knowledge to even solve textbook problems much less do research! Much of this failing was due to my lack of maturity as some of my colleagues did much better. The reputation many outstanding students from India had created in Universities in the US combined with my grades were sufficient to get me admission to Northwestern University for a Ph.D. program with a full teaching scholarship. I arrive in Evanston, Illinois on September 9, 1975 with ten dollars in my pocket and the opportunity to define what I wanted to do with my life.

I was totally oblivious of how poorly prepared I was to do research when I arrived at the Physics Department in Northwestern University. Luckily the graduate courses started with the basics and I was able to catch up. My roommate, P. K. Aravind, was a year senior to me and had adjusted well to the system and was already highly respected. Most other Indian students had gone through a similar transformation and had settled down quickly. This camaraderie shielded me from looking back at wasted years and asking the question – had I already lost the opportunity to be a scientist?

I excelled in all the coursework and in the Ph.D. candidacy exam, and on the basis of these qualified to work with Dr. Robert Oakes. Unfortunately, he did not have funding to support me and even if I had stayed I would be the only student doing research in high energy physics. Bob Oakes encouraged me to apply to other schools with strong programs in particle physics even though he would be losing a student – how very different from the many possessive professors I had known in India. I am sure his letter of recommendation was probably the most significant factor resulting in Caltech offering me a position in their Ph.D. program.

It would be a lie to not admit the culture shock during the first year at Caltech. The daily reminder of what Feynman and Gell-Mann could learn and calculate overnight, the clarity and depth of their knowledge, the maturity of other graduate students compared to my own journey of having started to learn to do science just two years ago was challenging. Fortunately, I persevered and survived. The break came in the second year when Rick Field taught a course in field theory and QCD and I offered to be a teaching assistant along with Steve Otto. Steve and I worked through a number of detailed 1-loop calculations in QCD, problems that had been done for the first time just 2-3 years ago. This course led to a research assignment with Rick who assigned us to do the 1-loop QCD calculation of the pion form factor. Steve and I worked independently, compared notes and would periodically update Rick who was always encouraging and supportive. After six months of hard work, with this calculation in the bag, I had first taste of “original” research. We had also achieved the first of what was expected of Caltech students – solve problems on our own. This capacity to work independently was timely as Rick left for the university of Florida soon after we finished the calculation in 1980. That one calculation of the pion form factor was not sufficient to satisfy the requirements for a Ph.D. degree from Caltech.

Having just finished a calculation using perturbative QCD, Steve and I were aware of its limitations at the hadronic scale. Mike Creutz had just published his seminal paper on calculating the string tension in QCD using Lattice QCD to explain confinement. So we started to learn lattice QCD by reproducing Creutz's results. This led to the second project – calculation of the mass gap of the $O(3)$ non-linear sigma model, a model that shared many properties with pure gauge QCD but for which much more precise calculations could be done. This gave me further confidence, not only did I do the full calculation by myself but also formulated the project and did all the analysis. Again Geoffrey Fox, who had become my official thesis advisor when Rick left, was outstanding in his support and encouragement. What fascinated him much more than the lattice field theory calculations were the computational aspects. In 1981 it was clear to all of us that the computing resources we had at Caltech were inadequate to solve QCD and many orders in speedup were needed. As best as I can recall, my first motivation to think about parallel computing came following a talk by the Santa Barbara group who had built a special purpose processor to solve the Ising model. Unfortunately, I only participated in the initial brainstorming and conceptualization of the Caltech "Cosmic Cube" before graduation, however, the belief that parallel computing was the way of the future and the desire to calculate the critical exponents of the Ising model were to stay with me. These interests I indulged in after coming to Los Alamos in 1985.

The main lessons I carried from my years at Caltech were: the only reason to do science was because you love doing it, to experience the beauty in its rigor and validation, and the excitement of being surrounded by exceptional people. The experience of watching two geniuses (Feynman and Gell-Mann) perform was humbling but at the same time I had become confident that I could make contributions to science if I worked hard, chose problems that matched my strengths and never stopped asking new questions.

My post-doctoral position was at Northeastern University with Dick Arnowitt and Pran Nath. This was not a position that I could have foretold getting. The position had been offered to Joe Polchinski, who eventually went to Harvard. My application had been misplaced. It was a timely call to Bill Celmaster who resurrected it. Dick and Pran gambled on my field theory background and hoped I would contribute to some of their interests, which in reality were so distant as they were working mainly on supergravity. Again, it speaks volumes of them that they left me to work on whatever I chose and supported me in every way possible. My three years at Northeastern were extremely productive and fun. At Northeastern I collaborated with Bob Cordery and Mark Novotney on Monte Carlo Renormalization Group methods with applications to both statistical mechanics and lattice field theories. This work led to a collaboration with R. Shanker at Yale to understand why the MCRG method works so well. With Apoorva Patel at Caltech I continued calculations of the hadron spectrum using Lattice QCD. Once again the support of Geoffrey Fox was invaluable. At Harvard I met Belen Gavela and Rich Brower and we initiated the calculations of weak matrix elements using lattice QCD. Most significantly, I teamed up with Steve Sharpe and Greg Kilcup to form the nucleus of one of the leading Lattice QCD collaboration that would survive for over twenty years.

The work with Bob Cordery and R. Shankar brought me in contact with Ken Wilson and Bob Swendsen. Even though I did not work with either of them, their influence on my work and future has been enormous. A chance meeting with Gerry Guralnik at Harvard, and through him Chuck Zemach, eventually led to my coming to Los Alamos as a J. Robert Oppenheimer fellow. At Los Alamos I spent the next fifteen and extremely rewarding and focused years working on numerical simulations of Lattice QCD and statistical mechanics, and the development of parallel computing. Looking back, these were years that define my most productive academic career with a steady output of high quality work and publications. This was also the time when I became part of an American family, I married Alice Chapman and she gave birth to our two sons – Neel and Nevin.

During 1998 I had the tremendous opportunity to work with Tanmoy Bhattacharya and Bette Korber on estimating the timing of origin of the modern HIV/AIDS pandemic using phylogenetic methods. That work brought me back to a deferred concern. My understanding of the extent of risky sexual practices prevalent in India had convinced me as early as 1988 that HIV/AIDS was an exceptional disease and that a large part of the Indian population would be highly vulnerable. I was, however, too pre-occupied with research to actually do something to help. The foray into modeling the evolution of the HIV virus in 1988 reinforced my convictions, yet it was hard to break the routine – to continue doing research in lattice QCD and bio-informatics versus getting involved in social issues and development. Once again an unexpected fork in my life loomed, and once again I choose a road on impulse and the more unknown one.

Two events in December 1998 played a very significant role in precipitating my involvement with HIV/AIDS education. The first was a remark by my six-year old son Neel during a trip to India. "Dad, people are so nice to us and so helpful but there are so many that have nothing. We must do something for them." The second were interactions with Mr. Prem Nath, Secretary of Dayanand Medical College and Hospital in Ludhiana, who introduced me to the hospital's medical staff after listening patiently to my explanations on why HIV/AIDS would be a serious threat to India. Their parting remarks were "If you bring us adequate information, we will start an HIV/AIDS cell in the hospital." I returned to the USA pondering the questions – what information could a physicist provide highly qualified doctors on HIV/AIDS prevention and education? Second, I knew Mr. Prem Nath was serious in his offer, what did his offer imply in terms of a plan for action?

A subsequent telephone conversation, in which Mr. Prem Nath reiterated the above statement, convinced me to develop education material that integrated the social, medical and economic repercussions of the spread of HIV/AIDS. The next challenge, in addition to educating myself, was to determine if I would be an effective communicator to high school and college students on the subject. Lastly, any such commitment would require very significant support from my family so I discussed the idea with my wife Alice. The matter was sealed when she, without a moment of hesitation, said I must. So over the next six weeks I worked furiously to learn as much as I could and developed a number of talks on subjects ranging from the germ theory of disease to the latest understanding of the viral dynamics of HIV/AIDS and opportunistic infections. Alice was once again

instrumental in my paying attention to “communication strategies.” I started making Powerpoint presentations with graphics and simplification of concepts rather than hand written transparencies containing scholarly talks.

The next hurdle to overcome was entry into Indian schools to give a talk on HIV/AIDS. This was not easy in 1999 (nor is it easy today!). I was very fortunate in having Mr. Prem Nath and Mr. Arun Kapur, the director of Vasant Valley School in New Delhi and a friend from college days, plan my schedule and arrange for me to give eleven lectures over eight days in Delhi and Ludhiana, Punjab. Arun used his connections to convince fellow principals in Delhi while Mr Prem Nath’s stature as a pillar of society in and around Ludhiana was pivotal in gaining access to schools.

The typical format of my interactions with students is that I request two hours, the first hour for the lecture followed by an hour of questions. Right at the beginning of the class I request the students to write any question they have on a piece of paper so that the questioner remains anonymous. It has the additional benefit that even the most sensitive issue and topic is considered appropriate to discuss in response to a question that has been raised by a student. This format has been very successful and at times even I am amazed by the frankness with which I can answer the questions and yet have the school accept it as a job well done.

Giving two or three such lectures a day during my visits to India was tiring but initially it was not emotionally draining as I had not experienced a real-life shocker. This changed after one student confronted me with the question, which in short asked, “Sir, my father is abusing me. What should I do? Why could he not have been satisfied with my older sister?” The student had the courage to seek me out after the lecture and had asked for help so I felt compelled to respond. I started by discussing the matter with the principal to find out what help the school could provide. The principal refused to even accept that such things were possible. He was convinced that this was yet another example of the unimaginable dirty stories that kids of today, influenced by TV and the West, invent. I spent the next two days calling up hospitals and clinics to find out what professional services were available. The three child psychologists I reached all confirmed that sexual abuse of children was common, that professional counseling and help services did exist but were rarely used. The medical professionals seemed resigned to the reality that Indian families were not yet ready to face up to such issues nor seek professional help. I finally reached the girl’s mother by telephone. She was clearly aware of the problem but was overwhelmed by the very real possibility of social disgrace. She was adamant that the only option, considering the overall welfare of the family, was to stay quiet and that I should not contact them any more. Her words “as a fellow Gupta you clearly understand the social complications” still ring in my ears. From that day on HIV/AIDS education was no longer impersonal. I became acutely sensitized to the multi-dimensional social and economic context in which HIV/AIDS spreads.

February 2001 marked another turning point in my evolution as an HIV/AIDS educator. Until that point in time I was focused on visiting as many elite urban schools as possible to present my talk on HIV/AIDS and spread awareness on this scourge. I had made many

attempts at giving a talk at Sree Ram School in New Delhi but there was no response to my requests so I finally met with one of their teachers, who is the wife of a friend from college days, to find out why. She put it very bluntly – “you are wasting your time with elite schools like ours. We get requests from leading NGOs and HIV/AIDS educators daily and we can pick the very best to come and give presentations when we want. If you really want to do something useful you should go to poor schools, especially those in villages, and work with them.” In retrospect this humbling and deflating experience was valuable because I decided to take her advice. I decided to shift my focus to rural India. But I had no connections and did not know where to start.

Four events led to opportunities. The first was my chance visit to the NGO Arpana in Madhuban and a meeting their medical director, Dr. Ela Anand. Arpana is a charitable organization that works on rural development in 36 villages around Karnal in Haryana. Aunty Ela, as everyone calls her, is a rare and genuine individual whose every pore radiates warmth and love. Through her I got to know many members of the Arpana family, in particular Mr. Ratti Sabharwal, Ms. Aruna Dayal, Ms Mamta, Mark and Anne, and they arranged for me to work with their health workers and conduct classes with villagers. This introduction to rural India opened my eyes to another related scourge – alcohol abuse – that is a very serious impediment to development across India. I was also fortunate to meet the spiritual leader of the Aprana organization, Amma, twice but my rebellion against organized religion remains too deep rooted to appreciate her power and message.

The second opportunity arose through a chance meeting with Hardy Dewan, a classmate at Delhi University during 1971-75. Hardy is an educationist and influential in institutions run by Bhartiya Vidya Bhavan in Udaipur. He invited me to visit Udaipur to speak to students in schools administered by him and two other private schools. The school lectures drew the usual enthusiastic response and a lot of questions from students but it seemed unlikely that there would be follow up beyond that visit. Fortunately, Hardy’s wife Neelima Khetan, who is the director of Seva Mandir, one of the premier NGO working on rural development in Udaipur, saw value in my approach and invited me to help train their village health workers in HIV/AIDS awareness and prevention during my next visit.

Six months later I reached Udaipur by an early morning flight from Delhi and was taken to Seva Mandir’s educational center by Neelima. On the way there I ask her what the schedule for the day was and how I would fit in? Her reply was very matter of fact. “We have organized the trainees into two batches. The first batch arrived last night and will be with you until lunchtime tomorrow and the second batch will meet with you starting after lunch.” The reply to my second question – where did I fit in – was equally straightforward. “Each group is all yours for the duration of their stay here. You can spend as much time as you wish with them and if you get tired or have nothing more to say then the regular instructors will take over.”

I enter the classroom armed with my laptop and Powerpoint presentations, which, as you can guess, were useless, especially as the projector failed to work. I was now confronted

with a group of about 60 men and women ranging in age from 16 to 60 and with educational backgrounds ranging from no formal education to high school. Fortunately, while Hindi is not their native dialect, they all understood it. Having crossed the basic communications hurdle I faced the next one – where and how should I begin? Looking for help I noticed, drawn on the blackboard, an outline of the reproductive organs of a woman, which I presumed was the subject being discussed. So I decided to start from the beginning – the human body, the germ theory of disease, menstrual cycle, reproduction, sexually transmitted infections, HIV/AIDS, and its social trappings. Somehow, my naivety and enthusiasm was infectious enough and my failure to anticipate that there is no simple clinical vocabulary in Hindi for anything I was supposed to talk about, i.e., sex, coitus, and various sexual practices, was overcome by turning the lecture into a game—who in the audience could guess and explain what I was talking about. Solutions were manufactured in real time. Whenever I needed to describe a sexual practice I would pause, look for help, and the audience and I would together invent the words to describe it and use this description subsequently. I ended up spending 12 hours with each group providing information and relating it to their daily life, conducting small breakout groups where each trainee rehearsed how they would talk and spread awareness on issues around sexuality and HIV/AIDS to their community. Breaks were punctuated by tea laced with ginger and mint and listening to them sing folk and devotional songs. Was I successful? I am not sure as no formal impact survey has been carried out. The fact that Seva Mandir thought it was very successful and that many of the trainees thanked me during subsequent visits, firstly for changing their lives and secondly for providing them with the confidence to talk about such sensitive issues was adequate confirmation of success and sufficient motivation to continue.

My introduction to the world of gay and transgender communities was facilitated by Ashok Row Kavi in Mumbai and Dr. Sai Subhasree Raghavan (founder of SAATHII) in Chennai. Both are very energetic and strong willed individuals fully devoted to stopping the spread of HIV/AIDS in India. While I learned a lot and was able to communicate with these communities, I felt that I lacked the ability to identify with this community and their emotional and sexual needs. I, therefore, concluded I would not be effective.

The final chance encounter was with Urmi Basu, who runs the NGO Newlight that helps sex workers and their children in the Kalighat area of Kolkata. During my visits to Kolkata I also got to know the doctors and leaders of the sex workers union at Sonagachi. Interactions with these marginalized communities were eye openers. It was heart rendering to understand the circumstances that forced many of them into prostitution. It was painful to see a whole community that made a living selling sex to be so ignorant of, and powerless to protect against, sexually transmitted infections. We clicked! They saw in me a lovable caring person and I saw a vulnerable community in need.

Starting in 1999, I had been regularly posting articles describing my experiences with HIV/AIDS education on the web (<http://t8web.lanl.gov/people/rajan/AIDS-india/>) and volunteering my time as a HIV/AIDS counselor. These articles were being read by HIV/AIDS groups in India (through responses to them I met Askok Raw Kavi, Dr. Raghavan and Urmi Basu) and on average I was counseling one person a week by e-mail.

In 2003-04, I wrote a monograph detailing my experiences with education on addictions and the spread of HIV/AIDS that is posted at http://t8web.lanl.gov/people/rajan/AIDS-india/Gupta_HIV_India.pdf. Writing this monograph created another fork in my life and the need to make another decision. I knew enough about the spread of HIV/AIDS to know that if stopping it was my prime goal then I needed to work full time on it. I had also developed the conviction that stopping the spread of HIV in any significant way would require development and economic independence in particular, so that people have the freedom to make safe choices. Economic development requires access to education, jobs and resources of which an important one is energy. So once again I had to make a choice, either engage full time working with the marginalized on HIV/AIDS prevention or jump into understanding an even larger issue—energy security and how to provide cheap clean energy to the global population. I chose the latter because of its scope, because I felt I could contribute more and because it was closer to my professional training.

Another factor in the decision was the emotional stress of interacting with the marginalized, drug abusers, and HIV/AIDS infected. It was beginning to overwhelm me. Two events illustrate the emotional highs and lows one can face even when teaching high school students in a highly educated community like Los Alamos. The high came when one day I noticed a girl with a lesion on her face as I entered the classroom. It reminded me of pictures of Herpes Zoster outbreak I had seen in medical books I had perused. I insisted that she go and see a doctor immediately even though she resisted as she was afraid her parents would get upset at the ensuing medical expenses! I somehow convinced her teacher to take her to the school nurse. Four days later when I returned for the next lecture I found her waiting for me with a beaming smile to thank me for getting her to go see a doctor. Yes it was Herpes Zoster, and early diagnosis and intervention had prevented her face from getting scarred. The low came in a class on drugs and their effects on a human brain. One of the students was hyper-stimulated throughout the 90 minutes of the class and I was afraid I was watching a kid under the influence of the very drugs I was talking about. Later I learned that he had to be taken to an emergency room the very next day for methamphetamine abuse and had ended up with serious brain damage.

Over the last three years my intellectual curiosity has been dominated by solving the energy-environment-development-climate (EEDC) challenge. Once again it is outside of my mainstream research interests, which as you can well imagine, have not received undivided attention due to the many tangents my life has taken. To understand and address the EEDC challenge I have created a “Global Energy Observatory” GEO that aims to be a one-stop site for information on global energy systems with the hope that knowledge in the public domain and their informed engagement will lead to enlightened decisions. The prototype of this GEO is at <http://openmodel.newmexicoconsortium.org/> and I would be delighted to work with any of you interested in this area and to explore mutual interests. Building GEO has allowed me to learn about energy systems and information science by first jumping into a project and then learning the tools—perhaps an enduring characteristic of my life.

I feel I am leading a magical life. To have the opportunity to think about the deep secrets of nature, to understand the good and bad in people, and to work on grand challenges of the day has been deeply satisfying. I am not sure any of this would have been possible without the values my parents provided, the enabling and intellectually rich environment I have been engulfed in since the day I came to America, the support of Los Alamos National Lab, and the love of my family, friends and colleagues. What else can one ask for in life?