Responsibilities of Science, Responsive to Society: A New Dialogue

Jairam Ramesh

Abstract In India, a mosaic of languages, cultures and political systems, where stakeholders differ drastically in their beliefs, value systems and expectation from the government, introducing a policy to implement or discard a novel technology is a Herculean task. In this chapter, comprising an edited version of the author's lecture to a scientific community followed by questions and answers, the author shares the challenges he had to face while taking decisions as a cabinet minister in four different contexts where science collided with Indian society: Bt Brinjal (India's first genetically modified food crop), Jaitapur nuclear power plant, climate change in Himalayan glaciers and mining in Niyamgiri Hill. Based on his personal experiences the author proposes five principles that would form the basis of a new dialogue on making 'people more science-friendly and scientists more people-friendly', and elaborates the role of these principles in understanding and explaining various dimensions of science–society interface.

Keywords Bt brinjal · Jaitapur nuclear power plant · Climate change · Himalayan glaciers · Niyamgiri hill · Public–scientist interaction

I want to tell you four stories on the science–society interface, which I had to grapple with, particularly when I was Minister for Environment and Forests. These stories are of Bt Brinjal, which is a story of biological science colliding with society; of *Jaitapur* which is a story of nuclear science colliding with society; of climate change in Himalayan glaciers, which is an instance of atmospheric science colliding with society and, lastly, about mining—Vedanta, POSCO, and the associated *Go's, No-Go's*—where ecological science collides with society. I shall conclude the lecture covering these four case studies by deriving five principles—lessons, which

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I hope would form the basis of a new dialogue. How do we take this dialogue forward? How do we make science more responsive to society—and conversely—the society more responsible towards science? This is a subject that has long fascinated me, and I just discovered in my archives, a special issue of *Dædalus* published in 1974, titled, 'Science and its public, the changing relationship'. The issues of science–public relationship have been discussed by eminent scientists including Nobel Laureates like Steven Weinberg largely, of course, in the Western context. But the theme is pretty much the same: How do you take science to the people? How do you make people more science-friendly? And how do you make scientists more people-friendly?

So, over four decades later, we are discussing pretty much the same theme, albeit in the Indian context, and particularly relating to the decisions I took as a Minister. Let me start with the first example, and I am going to be frank. I am not going to be saying anything different than what I have said earlier—and I have never shied away from controversy even when I was a Minister—but I may add few comments based on the developments since the time those decisions have been taken.

Bt Brinjal was the first issue. I took over the Ministry on 29 May 2009. The very next day reporters from ten TV channels stormed my office and asked, "What are you going to do about Bt Brinjal?" I said, "What is Bt Brinjal? What is this Bt Brinjal all about?" Eventually, I called my officers and asked them, "Is there something on Bt Brinjal going on around here?" Indeed, we had an immediate case for the commercialisation of Bt Brinjal. "Bt Brinjal," said my officers, "is very essential for the food security of our country." I joked with them whether those who did not like *Baingan Bharta* (a mashed Brinjal dish) would get to like Bt Brinjal *Bharta*!

In the days to come, I was inundated with questions on what the government was going to do with, or what was going to be the scheme of commercialisation of, India's first genetically modified food crop. I was aware of the debates on Bt Cotton. I had written about Bt Cotton, I knew about the political debates, the economic debates and the technical debates, and I was also very sensitive to the fact that over 94% of Indian farmers had adopted Bt Cotton. They cannot be all irrational or wrong, and, as an analysis subsequently showed, about 20% increase in the yield that India had 2000s was attributable to the introduction of the Bt Cotton varieties. India has gone from being the third largest cotton producer to become the second largest cotton producer in the world. Undoubtedly, barring the State of Maharashtra, where cotton is largely rain fed, wherever you had irrigated cotton, Bt Cotton has been a success story.

But Bt Brinjal presented a completely different set of issues. For one, the civil society mobilisation was far more systematic, serious and extensive in the case of Bt Brinjal than it was in the case of Bt Cotton. I think Bt Cotton was seen to be something between the seed companies, the research laboratories and the farmers, whereas Bt Brinjal brought in the consumer. Thus, there were many consumer organisations, a number of advocacy organizations, NGOs, environmental activists and farmers' organisations presenting a whole new set of issues. And then of course, you had the scientists, who said that without Bt Brinjal, Indian agriculture was doomed, and food security, as I mentioned, was going to be dependent on Bt Brinjal.

So what did I do? My response after all the briefing I received was something, which was not liked by my colleagues in the government; I started a process of public consultations. I had seven public consultations in seven parts of the country: Chandigarh, Bhubaneswar, Ahmedabad, Kolkata, Nagpur, Bengaluru and Hyderabad, in which about 8000 people participated. These were open consultations organised by Kartikeya Sarabhai's Centre for Environment Education. Nobody could accuse Kartikeya of being anti-science, and it was his organisation that invited people, scientists, farmers, consumers and the general public. The whole idea was just to listen to the people articulating different points of view.

And these public consultations, of course, became very acrimonious. Because nobody was talking *to* each other, everybody was talking *at* each other; the scientists were arrogant in their certitude and the members of the civil society were equally obnoxious in their cocksureness because civil society felt that they had a monopoly on social conscience and scientists believed that they had a monopoly on knowledge. Therefore, actually these public consultations did not become a dialogue. They instead became occasions on which people aired their views. Scientists said what they had to say, activists said what they had to say, and as it so often happens, activists were far more articulate and louder than scientists. Therefore, by and large in each of these consultations, the message that I received was 'hasten slowly'. By all means, 'do not close the door for Bt Brinjal, but do not rush into it either', like we had rushed into Bt Cotton. These public consultations were one way of bringing science and public together.

The second route I adopted was to write to 70 top scientists of the world. I called Pallava Bagla of NDTV, New Delhi and obtained Bruce Alberts' e-mail address. I wrote, "Professor Alberts, here is my problem, here is the Bt issue, please tell me 60 top scientists across the world who are competent to judge what India should be doing in this area," and I got responses with some scientists saying we should go ahead and many others saying "Go slowly". Some scientists, of course, said, "Don't do it at all." So this was the second route of trying to bring science and society together, getting a much larger viewpoint from the scientific community. The third route I adopted was to contact the six scientific academies of India and, perhaps for the first time in their history, all the six academies came together to the table—and were civil and cordial with each other, which was a very rare occurrence—to share with me their views on what India should be doing on Bt Brinjal. Dr. M.S. Swaminathan, considered one of the key players of India's first green revolution, cautioned me saying that India was a centre for genetic diversity for brinjal, and that I must go slow on this issue.

Now, I had many views before me including those strongly in favour, including those of my very good friend Prof. Pental who was then the Vice Chancellor of Delhi University. On my own part, I had very strong views that we should commercialise Bt Brinjal because that would send a signal that we were serious about biotechnology in agriculture. On the other hand, I had equally strong views from scientists, from activists something that you may not immediately appreciate, but very important in the Indian context and from every state government in India opposing the introduction of Bt Brinjal; *every* state government in India! You

know, 60% of brinjal cultivation is in three states, West Bengal, Bihar and Odisha, and they were opposed to Bt Brinjal. The states such as Maharashtra and Madhya Pradesh were also opposed to Bt Brinjal. What came to me as a complete surprise was that Gujarat, then under the chief-ministership of the present Prime Minister Mr. Narendra Modi, was also opposed to Bt Brinjal! Every state gave me in writing, "Do not commercialise Bt Brinjal." This was the dossier that I had before deciding the issue.

What was I to do? What I did was to put out a 20-page speaking order and I put all these views in the public domain (MoEF 2009, 2010). I put whatever I received —letters and views, including what Dr. Swaminathan had written to me—into the public domain, and said, "This is what these people have said." My speaking order said, "Let's have a Moratorium on Bt Brinjal," not an indefinite moratorium but a very definite, time-framed moratorium, until three conditions were fulfilled: (1) all states or a majority of states should be on board, (2) there should be an independent regulatory mechanism—a regulatory institution of independent professionals, that will certify that all the protocols and tests have been taken care of and (3) there must be a reasonable degree of scientific consensus that all the tests that are required on toxicity, safety, efficacy, and so on, have actually been conducted. I was quite surprised that the scientists themselves were divided on this issue. I had visited the National Centre for Biological Sciences, Bengaluru, and the Centre for Cellular and Molecular Biology, Hyderabad. The scientists I met there gave me sceptical, though not hostile, views. Therefore, my third condition was to let the scientific community, as a community, develop a broad consensus. And if these three conditions are fulfilled, the government of the day should remove the moratorium. I went out of my way to assure the public, "This is not a moratorium on biotechnology, this is not a moratorium on genetic engineering, this is not a ban on genetic engineering, but it is a limited issue of moratorium on commercialisation of Bt Brinjal for a variety of reasons."

I would not go into the detailed reasons, which were well argued in this 20-page note. One of the important reasons brought out in one of the presentations was the fact that a particular company controlled the bulk of the Bt Brinjal seeds, and that was an important issue, a sort of a red flag to all of us. So, to cut a long story short, a moratorium, a conditional moratorium, was imposed on Bt Brinjal. The moratorium imposed on 9 February 2010, continues in 2016. I left my office in 2011 and the expectation was that the day I left, the moratorium would be lifted. But it has not happened because, I think, there was a persuasive case for 'hastening slowly' laid out in my speaking order. There was a persuasive case for making commercialisation conditional. Those conditions, unfortunately, have not been fulfilled. Also, the states continue to oppose Bt Brinjal. The independent regulator is not in place, and the scientific consensus continues to elude us. Thus, the story on Bt Brinjal is one, I would say, of an initiative that got taken up with great enthusiasm and, no doubt, with great potential, but without asking the fundamental question that a political animal like me would ask: Is Bt Brinjal essential for Indian food security? That question, unfortunately, never got asked. Bt Cotton always had very persuasive

strategic arguments but those arguments fell apart in the case of Bt Brinjal, which then became an exemplar of science being a solution in search of a problem.

Now, let me move on to Jaitapur, where we had nuclear science colliding with society over the proposed nuclear power station. I was a hero to environmentalists till Jaitapur issue came up; then I became a demon to the same environmentalists. This was because as a minister I took the view that from a climate change perspective India cannot afford to ignore, or soft pedal, nuclear power which currently constitutes less than 5% of our overall energy supply. It must go up to 10% to 20% in a reasonable time frame of two decades. That this nation of 1.2 billion, going to be 1.7 billion by 2040, will meet its energy demand through its 'renewables' is a romantic notion. Even today, all the renewables account for something like 8% of the capacity and less than 2% of India's energy supply; and that is going to be the case for a foreseeable future. Therefore, for the next 20 to 25 years, India has to be a major player in nuclear energy, and I am not even getting into the 'thorium argument', which only gives an extra weight to what we should be doing in the nuclear sector. Jaitapur came and instinctively I wanted that Jaitapur should get the green signal (NPCIL 2010; DAE 2011). But everything went wrong on Jaitapur. Fukushima happened and after Fukushima, the entire discourse on Jaitapur changed. Local people came to me and said they did not know where Fukushima was—they would say, "Fuku-Fuku-Fuku-Fukushima"!—and they protested against Jaitapur. Added to this was the fact that Jaitapur was a frontier cutting-edge technology, which had not been used anywhere else except in Finland and perhaps in China. We were to be one among the first countries where a nuclear power plant of 1600 MW capacity was to be installed (my sympathies with Prabir Purkayastha; see chapter "Communicating Science to the Common People: Perspectives of the Science Communicators from India" for further information) on terms, which were considered to be of such great strategic importance that only very few knew what those terms were. We could not be completely open in Jaitapur for legitimate reasons. Part of the problem was that the transparency, which I could bring into Bt Brinjal, I could not bring into Jaitapur, because of the nature of the problem. However, the issues faced were identical. These issues were of confidence in the nuclear establishment, of safety in the wake of the world seeing what happened in Japan and of introduction of a new technology—a completely new technology. Another issue that came up, and still remains, was of indigenisation. India had gone for 40 years on the *Can do* route although the joke was that the *CANDU* had become the *Can Don't*! But the Can do route was the one we had adopted, and now we were going to go into a completely different nuclear track. Why not perfect the 700 MW *CANDU* reactor and proliferate the Indian design reactor rather than depend on somebody from outside? All these issues were raised when Jaitapur became a public issue. So what were we to do? How were we to get out of it? The easiest way would have been to say, "We are not going to give an environmental approval to Jaitapur." But that went against my education, my training, my instinct, my head and my heart—it went against everything.

Thus, I came up with the classic Indian solution: attach 36 conditions to the clearance. So this was a 'Yes', but a 'Yes-But'. If you see the Jaitapur's speaking order—all this is in the public domain—it was an environmental clearance for

Jaitapur subject to '1 to 36 being fulfilled'. Of course, Jaitapur now has not progressed to the extent that we expected it would progress. However, I think the imposition of the conditions was one way of demonstrating from the government's side—from the ministerial side—that we were sensitive to public concerns of safety, of outreach and of compensation. The issue that came up in Jaitapur included compensation to be paid to farmers whose land was being acquired and to the fishermen who were going to be resettled. Therefore, these conditions epitomised our commitment to embedding the concerns of people in the clearance process. But we cleared the project subject to the fulfillment of these conditions, and we also created a mechanism to ensure the monitoring of these conditions; not just you take that piece of paper and then you go and ignore what the conditions are, but actually make periodic reports and periodic audits of the extent to which these conditions were going to be fulfilled. Thus, while Bt Brinjal was a case of a 'No', a conditional 'No', Jaitapur was a case of a conditional 'Yes'.

Now let me turn to the third issue, climate change. When I came to the Ministry, one of the first things I read was that the Himalayan glaciers would be disappearing by the year 2035 (IPCC 2007). Dr. R.K. Pachauri, the Chairman of Intergovernmental Panel on Climate Change (IPCC) was credited with this statement. I found this something remarkable and wondered if Indians at large knew this was going to happen. I called a couple of my scientist friends and asked, "Have you seen this report of the IPCC?" They said they did, but also said they had grave doubts about it. I asked, "What are your doubts—scientific or non-scientific?" When they said they had scientific doubts, I persisted, "Why haven't you spoken up? Why haven't you communicated what you believe are your doubts?" Scientists having doubts is very rare! When they do have a doubt, the media would definitely run to them. They said, "No, Sir, because we couldn't, … IPCC, a global body … Government of India …" I said, "Look. I want India's top glacier experts to come. Let us have a round table, and let us discuss the issue of Himalayan glaciers."

Thus, I got the scientists for a round table. Dr. Kasturirangan (Former Chairman, Indian Space Research Organisation, ISRO) came, and I also got other people from ISRO. I got a 75-year-old gentleman, V.K. Raina, a geologist from Geological Survey of India. He has, in the course of 55 years, visited something like 3000 glaciers. Not a Ph.D., but India's authority on glaciers, and called 'India's Mr Glacier!' I said, "Mr. Raina, please give me what your views are on the glaciers. And I give you two months. You prepare a report for me and I want to be educated and I want to educate my colleagues." He came out with the report, and it created a furor internationally! I got hate mail from every corner. The only person who supported me was the senior science journalist Pallava Bagla (2014). What did the report say? First, the report said that there are about 10,000 glaciers on the Indian side of the Himalayas. Second, most glaciers are retreating but some glaciers, like the *Gangotri* glacier, are retreating at a decelerating rate! Very interesting! *The Gangotri glacier is retreating at a decelerating rate!* Third, there are some glaciers, which are actually advancing! The famous *Siachen* glacier, for example, is actually advancing! And last, which was the most important part of the report, the clincher, that Himalayan glaciers are fundamentally different from Arctic glaciers, because

their snout, that is, their lowest point, is at least 3000 metres above sea level! And that therefore the behaviour of the Himalayan glaciers a priori cannot mirror the behaviour of the Arctic glaciers, in response to perturbations. We put out this report and I stuck my neck out: "Look", I said, "Indian science, you know!" I believe science is science, I don't believe in Western science, Indian science, Vedic science and all these, but this was one instance where I said that Indian science, the science done by Indian scientists, has established that Himalayan glaciers will NOT vanish by the year 2035! The situation is, however, very complex. It is a dangerous situation because the health of the glaciers is very poor. The glacier melt can adversely affect water supply, but let us not get into alarmist evangelism: here, I wish to cite an example of how alarmist evangelism can be dangerous for India.

In 1990, the United States came out with a report that methane emissions from Indian agriculture were 38 million tons per year. Alarm bells rang all over India. We can manage CO_2 emissions because CO_2, as you know, is man-made. But anthropomorphic methane is derived from cattle: we cannot do much about 250 million cattle! You can manage a billion people but you cannot manage 270–280 million cattle! However, this methane and wet paddy—paddy being staple in India—set out alarm bells. I must complement the late Dr. A.P. Mitra (National Physical Laboratory, NPL, New Delhi) who took up the challenge and said, "This measurement is wrong." He started, I think through NPL, a programme for monitoring methane emissions in Indian agriculture and by 1994 came out with a report which said that methane emissions from Indian agriculture was 4, not 38, million tons per year! Today, the internationally accepted figure is 4 to 6 million tons! Had Dr. Mitra not taken that giant leap of faith, we would have been under enormous pressure internationally to manage methane emissions; because, from a climate change point of view, carbon dioxide may be more preponderant but methane is more potent. So, Dr. Mitra and this glacier are a similar story. We depended on somebody else's science. Science which had had not just a scientific agenda: This notion that scientists are politics free, value free—it used to be said of George Nathaniel Curzon, he was a superior person—now this notion that they are superior persons bereft of human emotions like politics is a myth! Much of the science in today's context is political, to drive political agendas, both internationally and domestically. Himalayan glaciers was one such example where clearly the scientific community was behaving like evangelists and not like scientists till a report came out of India. Even my Prime Minister asked me, "Are you sure about what you are saying?" I said, "Sir, I have consulted all the experts, this gentleman swears by what he says, and I am prepared to back him 100% to the hilt." The day we released the report, Dr. Pachauri put out his press release calling it Voodoo science! NGOs burned effigies in Copenhagen. But to cut a long story short, subsequent events proved Mr. Raina right. IPCC for the first time issued a retraction saying they were wrong, their peer review process was wrong and slipshod and that the Indian Government's position was the more nuanced and right position.

Thus, in the case of climate change, when science collided with the public, it was not public that was wrong. It was science that was at fault. It was science that had created this great atmosphere that glaciers were endangered. And when somebody

challenged that science, the truth came out differently. The point I want to make is that this scientific method is the method of questioning. The scientific method is a spirit of enquiry. It is a spirit of doubt. If we are to accept everything coming out of scientific establishments, as gospel, I think that goes against the very grail of science. Dissent is part of the scientific DNA, which will be tried to quell at every step. And in the case of the glaciers, if we had not allowed that small window for dissent, we would not be in this situation today where the world community recognises the complexity of the Himalayan glaciers' issue and does not get into sensationalism and fear mongering, that the Himalayan glaciers are going to disappear by the year 2035 (Bagla 2014).

Let me now turn to the final issue of mining, which is perhaps the most complicated issue; these are not just scientific issues; these are human issues and livelihood issues, as Dr. Meenakshisundaram has pointed out (see chapter "Communicating Issues Related to Land and Natural Resources"). In the case of the mining issues, an issue of faith was also involved. In the case of Vedanta, bauxite was going to be mined from a mountain that is considered to be religious. I would like to ask of the urban Indians, "Suppose diamonds were discovered underneath Ram Janma Bhoomi—the sacred shrine believed to be the birth place of Lord Rama—by some miracle; would India tolerate mining at Ram Janma Bhoomi?" No! If the Niyamgiri Hill is considered sacred for the Dongria Kondh tribal people of India who are we to determine what is right for them? That was the issue in Vedanta. Only 5 % of the total bauxite supply for that 6 million ton alumina refinery was to come from this mountain. They could have found this bauxite anywhere else. But it was the certitude. This is what we want; this is what we will get. This is *zabardasti*, to use a Hindi word for brute force. In the case of Vedanta, it was a mountain that was considered sacred. It was not a scientific issue, but an issue of faith, an issue of culture and an issue of lifestyle. To my mind, a public issue is as important as a scientific one.

In the case of POSCO, which Dr. Meenakshisundaram shared with us, in which again I had the misfortune of being entangled, it was a straightforward case of land acquisition. People grew betel leaves in the region and these leaves were supplied all over India. And they did not want to part with their land—it was as simple as that. Seven villages' land was to be acquired, five villages agreed, two villages did not agree and that is how the POSCO issue came up. It was a straightforward case of livelihoods being lost. Added to this was our poor track record in providing alternative livelihoods as well as resettlement and rehabilitation (R&R). It is learnt that R&R for Tarapur as well as for Biladila iron ore project that started in the 1960s is still incomplete. R&R for Bhakra Nangal is still underway. Now, in the face of this reality, what is the confidence level that anybody is going to evoke in the public when you say, "I am going to acquire your land and give you compensation and R&R"? Nobody is going to believe it! And that is what has happened in POSCO.

In the case of coal mining, the issue is a little more complex. It is related to ecological science. All the coal that India needs to extract in future is in thick, dense forest areas. Therefore, the more the coal you are going to extract, the more the natural forests you are going to destroy. You can always have artificial plantations, but you are going to be destroying hundreds, if not thousands, of hectares of

high-density, good-quality forests. It is noteworthy that although 21% of India is under forest cover, of this 21%, only 2.5% constitute good-quality forests; 40% of Indian forest cover is *Naam ke waste* (just make-believe) forest cover, namely degraded open forests. What we really call forests is only 2.5% and that is where most of the coal mines exist. Now if you are going to extract coal at the pace being envisaged, then the country will pay a certain ecological price; maybe the country is ready to pay that price, but the consequences of paying that price is what the public is responding and reacting to. The result is, lands are being acquired but compensation is not being paid and R&R is not being completed. Then there are mines being worked, finished and not being restored to their original conditions; and that is not just some isolated case in India. These are the realities as far as mining is concerned. And in mining, I must say, the issues go much beyond science. They go into issues of legality, of land acquisition, resettlement, rehabilitation and so on and so forth (Saxena et al. 2010).

Now, from these four examples, Bt Brinjal, Jaitapur, climate change and mining, what are the general principles that one draws? These are nice, interesting stories, and for those of the readers who are interested, all the material on each of these is available in the public domain. I have not said anything, which is not in the public domain. To draw up the principles, the first thing, I think we must recognise, is that growth is essential—there is no questioning that India must grow at 7.5-8 % per year. Between 2004 and 2014 the average GDP (gross domestic product) growth was 7.7%. For those who know the compound interest tables by heart know that if something is growing at 7% it is doubling every 10 years. This means, basically, a GDP growth of 7.7% over a 10-year period has meant that the GDP has doubled in the last decade, even though there has been a slow-down in the past 2 years. We must get back to an 8% growth trajectory on which there can be no doubt whatsoever. But, in the process of getting on to this 8% growth trajectory, issues that I have highlighted will become essential to the choices that we make. This 8% growth will not be without contradictions, complexity and conflict. I think it is the job of all of us to clarify how these contradictions, complexities, and conflicts are going to be managed. There are going to be, undoubtedly, choices that have to be made: investment choices and technology choices. Those choices will involve tradeoffs, and what those tradeoffs are will have to be made explicit and, as Dr. Meenakshisundaram puts it, made completely transparent so that decisions can be taken as a part of the democratic process. Now, what is this democratic process? This democratic process is not the government sitting with a huge mandate in Delhi or in a state capital but the locally elected bodies. Ultimately, we must recognise that if these locally elected bodies, *Gram Sabhaas* or *Palli Sabhaas*, as they are called in some states, are not a part of the democratic process of decision making, these conflicts, complexities and contradictions will never get resolved.

This resolution cannot be a top-down process. We are not China; I know there is a great fascination for China these days. We are not Japan either. We are India where chaos and anarchy is a part of the system. If we think that we are going to mastermind a top-down approach to managing these complexities of conflicts, we are sadly mistaken. This cannot be done in a centralised command and control

mode. It has to be done by involving local communities and local-elected representatives. I venture to suggest that scientists in India more than any other country in the world are a pampered lot. From Jawaharlal Nehru's days they have enjoyed unprecedented prestige, unfettered access and the Prime Minister himself and nobody else has always been the *karta dharta* (executive authority) of the scientific establishment. Therefore, the scientists have never felt the need to engage the democratic processes at the local level. With great difficulty they are engaging at the state level. Because if anything goes wrong, you can always run to the Prime Minister, whoever the Prime Minster is and the Prime Minister will set it right—whether it is biotechnology, nuclear, space, defence or agriculture. We need to understand that in this process of growth, to meet these complexities, contradictions and conflicts, and engagement with the democratic process at the grass roots is very much important. That is where the scientific community really needs to do far greater work irrespective of the area that we are talking about.

Now I derive five basic principles before I end my lecture. I derive these five basic principles for taking this dialogue forward. We recognise the value of science. We all know that science has much to contribute to the growth process. We all know that major investments have been made in science. But we are also aware that we are operating in an environment of scepticism in which there is questioning of science. There is an environment of distrust in many cases. So what is the way forward? I would suggest the following five principles for adoption, both by the scientific community—as a community—and by civil society which is loosely organised, but recognised as the spokesperson of the people's point of view, whatever that people's point of view may actually mean. But before we embrace these five principles, both sides have to accept that neither side has a monopoly on truth, patriotism or social conscience. Let us assume that truth, patriotism and social conscience are something common to all of us. Hence, the first principle: science needs to be less arrogant and society needs to be less suspicious. The second principle: science needs to listen, and society needs to hear. As I would like to tell my good friend, Rajendra Singh of Tarun Bharat Sangh of Rajasthan, *aap ko sunna hai!* (You must listen!) *Aap sunte nahin hain!* (You never listen!). *Aur jab maine aapko Kanpur ke IIT mein professor se milwaaya tha, aap ne mujhe kaha tha, "Yeh IIT waaley kya jaanenge?"* (When I introduced you to the professor in IIT, Kanpur, you said, "What do these IITeans know?") *Tees saal se Ganga cleaning ki baat ho rahi hai—tees saal se! Aur jab meiney saaton IITs ko pehli baar kaha, ki aap ek-jut hokar Ganga ke leiye ek action plan tayyaar keejiye, tab mere mitra, Rajandra Singhji ne pehli baar uthkar kaha "Yeh scientists kya kahenge? Hum se poochiye! Hum jaante hain Ganga ko kaisey saaf karna hai!" Toh aap ko sunna hai !* (The talks for cleaning of the river Ganga are on for the past 30 years—*for the past 30 years*! And when, for the first time, I asked all the seven IITs to unite and come up with an action plan to clean up the Ganga, my friend Mr. Rajendra Singh rose for the first time to say, "What would these scientists say? Ask us! We know how to clean up the Ganga!" Well, you [the civil society] have to listen.)

The third principle: science needs to be open to scepticism and society needs to be open to questioning. Today, we cannot question Sunita Narain (of the Centre for Science and Environment, New Delhi). She is a Goddess when it comes to environmental issues. You can't question Dr. Kalam (Former President of India) either! He is a God when it comes to scientific issues! Maybe I tried the wrong examples of the scientists, but with due respect to Dr. Kalam, science does need to be open to skepticism and society does need to be open to questioning. The fourth principle, which is what we are discussing here, is, science needs to be proactive in communication, not just active in communication! I presently explain what I mean by that. And the society needs to be less of a sensationalist and conspiratorial that Monsanto, for example, is out to enslave India! The Vandana Shiva (an Indian scholar, environmental activist and anti-globalization author) of the world. At the same time, Pental *Sahab* , you have to be proactive in your communication. Not when there is a crisis on Bt Brinjal; you start writing articles daily (when the crisis appears)! Where was the biotech community before Bt Brinjal? It was only when this Bt Brinjal crisis arrived that the scientific community woke up. Communication cannot be crisis driven; it has to be constant! Communication has to be done not necessarily with the view to convince, but it has to be done with a view to educate, which necessarily takes time. Finally, the fifth principle: science needs to develop trust. Nobody believes the Department of Atomic Energy on the future of the nuclear power generation: we say we are 3 % on nuclear energy and we will go to 6 %; they say 4500 MW will go to 10,000 MW, and we have heard this for the last 30 years. Society has to nurture confidence in the science we do and that will come when there is trust. I find the scientific community notoriously laggard in sharing information, I repeat, notoriously laggard! The more information you share, the more open you are, and the more trust you will build; also the more criticism you will get, no doubt. But I think science has to get out of the cocoon, if the scientific community has to develop the trust among the people.

So these are the five principles, and I recapitulate. First, science needs to be less arrogant, and society needs to be less suspicious. Second, science needs to listen, and society needs to hear. Third, science needs to be open to skepticism, and society needs to be open to questioning. Fourth, science needs to be proactive in communication, and society needs to be less sensationalist and conspiratorial. Five, science needs to develop trust, and society needs to nurture confidence. I believe that if we follow some of these basic principles, and if we get people together on an ongoing basis, we will be able to show a dialogue forward. The great weakness in the Indian system is the lack of institutional forums, where people from different points of view can actually sit down and debate with each other. Most of the time, it is the converted preaching to the converted. We value biodiversity, but when it comes to intellectual discussions, we make sure that there is no *bio-diversity*. There is a mono-culture. I venture to suggest to the scientific community that if we break out of this syndrome and provide institutional forums, these debates will become more and more significant in the years to come. There will be different points of view—some informed, some uninformed—but I think we do not provide the space. We have to provide the space for different points of view. We have to provide

forums for reducing the differences between the two different points of view. But I think the real challenge is, those in public life, when called upon to make decisions must have the intellectual honesty and the integrity to stand by these decisions; to put out these decisions in the public domain, to be held accountable for them, to be criticized for them or applauded for them, as the case maybe, and have the courage to say, "I have been wrong in some cases." That, "I should have done things differently." I have not yet reached that stage. We need many such interactions and of these interactions will come sensitization to both sides—not just to communicators, but to the activists also—and sensitization to the scientific community as well about the challenges they face in the larger public arena. Debates on nuclear power, renewables, environment, genetically modified crops, nanotechnology, stem cell research and so on, you name it, we don't know! I am just taking the examples of the technologies we are familiar with. These debates should continue. So I would like to thank Pallava—although he has not shared the proceeds of the award that he got on the Himalayan glaciers—and to all the people who are here. In the case of nuclear, I am a hero to you but because I am a hero to you, all the environmentalists think that I have sold out to you! So they are not easy choices to make—you are damned if you do and you are damned if you don't. So thank you very much.

Responses of Science Communication Experts

V. S. Ramamurthy (*Director, NIAS Bengaluru*): Thank you. And I think this is a closest view of the decision-making process in the government we could have had. Life was much simpler 50 years ago, one Bhabha and one Nehru would decide everything and everything else would be in place. But today, we are evolving into a system where both the sides have to interact on a continuing basis.

Shiv Vishwanathan (*Vice Dean, O. P. Jindal Global University*): Okay, Jairam … brilliant! You are the perfect crowd pleaser! As a storyteller you are brilliant! But your conclusions are absolutely trait! And I think that is the disappointment. If you look at it, each of your stories had better morals than you could conclude. Sometimes, maybe the storyteller isn't the best philosopher of his own story. Now, let me take this thing. You seem to operate for the model of rationality, which has to be questioned. Because what was really questioned in science was the rationality and the nature of knowledge itself. You have never raised that question. You seem to think whether this is Bt Brinjal or nuclear power they are all equivalent problems. They are not! Two, you seem to ignore the ironies of the system. To a certain extent, these can be zero-sum games. I mean, it is okay making fun of Sunita Narain or Vandana Shiva. But I think what they are trying to say is that your ethical position is much more complex than you make out to be. And I think there, you have to be much more complex. I think politicians, unlike scientists and activists, tend to make the world simpler than it actually is. There you have to take a certain responsibility. Because you are brilliant in the analysis of activism and science. But you black boxed yourself and I think that is something you will have to answer.

Jairam Ramesh: No, I don't disagree with you, Shiv, but I didn't have the luxury of rejecting the assumptions of, you know, the system, of which I am a part. I had to find a way forward for Jaitapur. Nicolas Sarkozy (Former President of France) was coming. He was signing this agreement. I am telling you facts. I had to find a way! I could not say no to Jaitapur. We needed nuclear power, climate change, you know, we had a huge investment in nuclear energy, I mean, I am just giving one example. So, I do not have the luxury, I am part of the system, okay? I am part of the problem. I do not have the luxury of being anarchist. I cannot say, I am not willing to say no to biotechnology. But I am willing to say "Put a moratorium on Bt Brinjal." I am not prepared to say, "After Fukushima, India must abandon nuclear power." But I am willing to say, "Let us do nuclear power subject to 36 conditions." I agree with you, that it is not a completely satisfactory position to take. Maybe now that I am out of power, I might actually do the things that you are suggesting but even so, I think, Shiv, if you look at the growth imperative for India, you will be hard put to take positions that are extreme in nature.

The Indian reality, and I haven't really spoken about this, but let me just take two minutes on this. You know, why should green growth be important for India? This is a question that has often bothered me for a long time, and frankly, when I look back on it, there are four reasons why green growth is important. India must be an exception to the 'grow now, pay later' model. All countries in the world follow the model of 'grow now, pay later'. America has followed this, China has followed this, Brazil has followed this and India is also following this. 'Grow now, pay later.' That's our 8 % growth for 20 years and don't worry about chemical contamination, pollution, asthma and cancer, 20 years from now. Why should India be different? And these are very important questions. All of us know, some youngsters are here, I am sure all of you are from the ecological community, we must ask this hard question, 'Why green growth?' Why should India be different other than the fact that we are the land of the Mahatma, who is the patron saint of all environmentalists? What is the first reason? The first reason is demographic. Most countries in the world are facing population declines. India is the only country in the world that is going to add 400 million people … in the next 30 years! That is our demographic *karma* (fate). Four hundred million people constitute one-third of our population, virtually! We are going to add in the next 30 years. Now, if your population is declining, you can maintain the current standards of consumption but if you are going to add 400 million people, you have got to worry about not just your consumption but also about what prospects you are going to leave behind for future generations. Are you jeopardizing their growth prospects? I mean India is the only country of her kind in the world! We are adding 10 million people every year to our labour force! 10 million! No country in the world … the United States and United Kingdom would also have population decline, had there been no immigration from India! It is the immigrants from India who are keeping their birth rates up: of course, India, Bangladesh and Pakistan.

So the demographic reason is number one. Second, there is a climate change reason. There is no country in the world, which is more sensitive, more vulnerable to climate change than India. But none of us recognize it. We all think that climate

change is some Western plot to keep us poor! Our dependence on the monsoon. Our dependence on the glaciers. Our dependence … you know, 300 million people living in coastal areas are vulnerable to increase in mean sea levels. And the fact that all our natural resources are in our forests! Third, today, environment has become a public health issue. It is no longer an environmental upper-class, upper-middle-class elitist pastime. It is a public health concern. Look at the incidence of asthma in children in Bengaluru—documented studies. Look at the chemical contamination of our rivers, Ganga and Yamuna—the disposal of toxic waste. Municipal sewage has led to serious deleterious public health concerns. And fourth, you recognize this more than anybody of us, in India environmentalism is not a lifestyle issue—it is a livelihood issue; 250 million tribals depend on forests for their livelihood. It is a livelihood issue. Hence, when people are agitating, we know, we may be calling it environmental in nature but what are they agitating for? Water rights, forest rights and land rights; they are bread and butter issues. Even so, green growth for us is not some luxury, *yaar* (friend), it has to be something fundamental to us.

And I think a part of our failure is that today in this current environment of growth and technology triumphalism that you see in the media and in the political discourse, I am afraid, the prospects for sustainable growth are now going to take a backseat. People are going to say, "Hmm … you know, let us grow and we will think about sustainability later and so on and so forth …". So the challenge for the scientific community and the challenge for the civil society in larger public, including media, is to reinforce this message of why green growth is important. Rajendra Singh would give you one example: *Teen saal pehle inhoney ek andolan shuru kiya tha ki Alakananda par jo baandh ban rahe thei, unko aap khatam karo*. (Three years ago, he launched an agitation to stop construction of dams that were being built across the river Alakananda.) Government had spent rupees 4000 crore already building these dams and he started an agitation saying that there is no water in the river anymore if you are going to build dams indiscriminately like you have been doing. And you know what we did? We stopped those dams! We stopped three projects. Everybody was furious but we actually stopped the construction of those dams because we said, "It is more important to have water in our rivers rather than generate some 1000 MW of power which we can find somehow." So these types of choices are going to be important, but the type of choice that you are asking me to make, which is, reject the green revolution, the poster that Pental showed us, "Reject the green revolution, reject private transport," I mean these are, I think, fundamentalism that nobody will buy in today's context.

Deepak Pental (Former Vice Chancellor, University of Delhi): First of all I don't think of you a villain for rejecting Bt Brinjal, I wanted to make that clear. But I would say that some mistakes have been made and I would just like to point them out in a minute. When you realized that there is so much opposition, and this Bt Brinjal is really not that important for India's food security, then what was the great fun in bringing the whole science of biotechnology and distribute by going to urban centres, opening it to these die-hard people who don't want to understand science, whatever gains we can make out of genetic engineering later on. And secondly,

when you said that you wanted an independent regulatory body, who had objected to it? The government of such bright people let it lapse! And I fully agree with you that we should question, we should be skeptical, this is the way sciences has moved on. I fully agree that technology deserves some questions what is the relevant technology and so on, but here is a technology which could be a game changer for India's 47 % population; then you talked about demographics, dividends or disasters whichever way one wants to see it, the fact is today 47 % of India's population is on agriculture. And in 2023, we will be 42 %. The actual number will be a little more than what it is today. So who is going to improve the farm incomes? Where from the increase in farm incomes will come? Only through low-input, high-output agriculture, and genetic engineering is one of the techniques. Why did we do some grandstanding within the ministries and why we didn't develop a cogent framework to say, "Look, this is no good, we will move to the next one …"; and I want to inform you that for one and a half years the GEAC (Genetic Engineering Appraisal Committee) has not been meeting! Now, that shows, you know apathy towards things; it is not hasten slowly. Something should have been cleared, and if nothing was worthwhile in India, everything should have been rejected. Now, that would have been like an acting government. We don't know where we are navigating, and we are doing it for the purpose of pleasing only the skeptics and who were comfortable with hasten slowly; and Dr. M. S. Swaminathan belongs to that category of scientists who believe in hasten slowly. This maybe great wisdom, but I don't think this is the way to provide leadership from the political class.

Jairam Ramesh: No, you see, I am sensitive to your point of view because had we hastened slowly, the first green revolution wouldn't have taken place. The first green revolution took place because we didn't hasten slowly. We just went ahead and imported 18,000 t of seed from Mexico and from the Philippines and we got the first green revolution going. But I think the difference between the first green revolution and the Bt Brinjal case, as you yourself brought out is, the first green revolution was entirely in the public domain. The seeds were available from CIMMYT (International Maize and Wheat Improvement Center) and IRRI (International Rice Research Institute). The seeds came to IARI (Indian Agricultural Research Institute), and it was entirely in the public domain. But now we are not talking about public domain science any longer. We are talking of private science. We are talking of highly oligopolistic science you know if not monopolistic. And that is what has created a lot of fears. I agree with you that if by this decision, India is going to abandon biotechnology in agriculture, then certainly Mark Anthony is proved right: "the good is often ended in their bones, the evil that men do lives after them," you know? The evil that ministers do lives after them, I agree. If that is going to happen, but I hope that is not going to happen. Because time in and time out again, I kept saying, "It is not biotech, it is not Bt general, it is Bt Brinjal case," and you use the Bt Brinjal case now. Why didn't we come up with the regulator? I don't know. It shouldn't take long for the parliament to pass (a bill to that effect); why was not this consensus created using state governments? I don't know! And Dr. Pental you would be surprised, state after state irrespective of political party—

Congress state, BJP state, Left Front state, BJD state, Karunanidhi followed by Jayalalitha—they never agree on anything but on this they agreed! I think it was a complete communication disaster, complete communication disaster from Day One. I will tell you something, with all due respects to all the scientists present here, you know when scientists retire, they get a different point of view than when they are in active service. Scientists become more society-friendly after retirement than they were in service. But this is not true only of scientists. It is true of civil servants also. Civil servants also become very friendly towards public and civil society activists after they retire! Actually civil servants, one year before their retirement, to prepare for their transition, they become more enlightened, you know? And they reach full enlightenment after their retirement, you know? So scientists are no exception to that. But I agree with you, it was a complete communication disaster!

K. S. Parthasarathy (*Former Secretary, Atomic Energy Regulatory Board*): As a minister at that time, were you not worried, why is it that all the state governments are against it?

Jairam Ramesh: Yes! I was completely flabbergasted! Let me tell you, Mr. Parthasarathy, if you read the Bt dossier decision on the website, every state government had an agricultural scientist giving a point of view to that state government. You know, Lord Cairns once said, a very famous quotation, "People in public life who think that they are free from the stranglehold of idea are usually prisoners of some defunct, economist." This quotation came to my mind. Because every state government had some retired Magsaysay or some award guy giving them the advice! It is amazing that not one state government said, "Go ahead". Even Punjab, Haryana!—it was shocking to me.

Umesh Srinivasan (*PhD student, National Center for Biological Sciences, Bengaluru*): I was just wondering, very often the media is the interface between the civil society and the scientific community. And if you read a scientific paper for example, it always nuances with hedges and caveats and you know context-specific things, say that this might be applicable to particular situations, it might not be applicable elsewhere and so on. But the nature of media, especially TV media, where you know, the nuances and the contexts are not brought out, I mean, what are the principles that you would draw? You have drawn principles for civil society, you have drawn principles for the scientific community. What are the principles you would draw for the media in terms of communicating science to civil society and vice versa?

Jairam Ramesh: Very good point. You don't depend on interlocutors. You must have direct contact between the scientific community and the constituency that you are engaged with. Do not depend on the media because the media is driven increasingly by a different cycle than what the scientists want and what, maybe, the people want. So I think it is important for a scientific community. Let me give you an example of what I am saying here, and I will take the example of a professor from Indian Institute of Science (IISc), a retired professor—Madhav Gadgil—and how he handled the Western Ghats report. He didn't depend on the media. He did direct interaction, to use an ugly phrase but a true phrase, with different stakeholders. And he communicated directly. Of course, Madhav's great advantage, which very few

scientists have, is the ability to communicate in non-English languages, you know? He communicates beautifully in Kannada, Marathi and Hindi, and you know he is not a typical scientist. He wears *khadi* (handspun cloth). Scientists are all people who come in suits, boots and all those things. He looks like a person who you can trust. Many people think the media is the interface. I would not trust that interface in today's day and age. I would strongly plead for direct interactions. If it is Jaitapur, between Nuclear Power Corporation of India Limited (NPCIL) and locally elected bodies, locally elected institutions, local organizations, local civil society organizations, and very often I find that the agreement that can be reached is far more probable when the media is absent. Because when the media is present, grandstanding takes place from both sides, you know? The scientists want to prove something and the civil society wants to prove something else. But this is not to say that we have to make an investment in upgrading the level of skills of the media. Pallava Bagla talked and took us through how (numbers of) scientists communicating have come down but science communication has also come down. Both of them have come down. Over the years, you do not have a critical mass of people who are communicating complex scientific issues in languages that people can understand. The number of people can be counted. And therefore I think, science communication is an investment, is an externality, is an investment that we must make. I don't know how many institutions run specialized programmes for science communicators, I am sorry that most scientific organizations that I am aware of think science communication as drafting a press release and releasing it; that is not science communication. Science communication is actually engaging the media, educating the media, explaining to the media what it is all about and also be prepared for some hostility and some skepticism from the media. Let us take an extreme example, Dr. Baldev Raj (Former Director of Indira Gandhi Centre for Atomic Research, Kalpakkam) takes a media team to Kalpakkam, to show what a great job we have done on our fast breeder reactor and we have done a fantastic job. Not many people know about it, but somehow he takes a media team. I can bet you if he takes ten people, there will be four people who will not write about the fast breeder. They will write about the increase in cancer incidents of the people living around Kalpakkam. Immediately he will get angry and he will say "*Media ko jaane do!*" (Don't care about the media!) This has happened. I am giving you a concrete example. This has actually happened. People have written, they have not written positive things about Kalpakkam and they have said about how people living around Kalpakkam have actually become more cancer prone, how people living in Tarapur have become more cancer prone and so on. So the scientific community has to be prepared for some backlash when there is openness. When you let sunlight in, not everything is going to be hunky-dory. There will be some criticism. There will be some degree of questioning which our scientific community must be prepared to accept; I am not sure that our scientific community is actually prepared to accept that degree of openness.

Ashish Navneet (*PhD student working on policies and politics of genetically modified crops in India*): My simple question to you is that within the government, Ministry of Agriculture and Ministry of Environments and Forests, aren't they

failing to generate consensus among themselves? Why they are coming with different opinions? Why they can't form common consensus?

Jairam Ramesh: I disagree with the premise of your question. The job of the Ministry of Agriculture is to promote genetic engineering, rather low-input, high-output technology, of which genetic engineering is one. The job of the Ministry of Environments and Forests is to do its diligence on the application of this technology. The job of the government is to create the consensus. If the Ministry of Environment is going to create a consensus, then it becomes a *thappa* (rubber stamp) ministry, isn't it? So, I take a different view. My view is that every person has to fulfill his/her *dharma* (obligations). The mandate of the Ministry of the Environment and Forests is to protect India's natural resources, protect livelihoods, ensure sustainability and not to promote genetic engineering. But the mandate of the Ministry of Agriculture is to increase agricultural output for which genetic engineering is one technology. Now the job of the government is a collective, is to create this consensus. Consensus is different from unanimity. Please mark my words. We can never have unanimity in these views. But we can have a consensus. Consensus means, *Aap ko sun liya, meri baat bhi ho gayi hai, yeh karna hai!* (I have heard you, I have said what I had to say, now we do this), that is consensus. Unanimity in my view is 'my way or the highway'! That is not possible in government. So what is lacking in India is forums which create these types of consensus that are durable. Sometimes they get done through strong-arm tactics, sometimes they get done through debate and discussion, sometimes they get done from outside the government, but please do not fall into this trap of thinking that all ministries must be monochromatic, that all of them must sing the same tune, that all of them are saying, "genetic engineering, *wah, wah!* (kudos!) Bt Brinjal, *wah! wah!*" That is not the way I feel democracies function. Democracies function best when each one articulates their mandate's view and then as a collective, we are able to come out with a consensus.

Kavita Kuruganti (*Alliance for Sustainable and Holistic Agriculture: ASHA*): I had a couple of things to say. One is that your whole presentation is somehow devoid of a political economy framework which once again is something that says science and technology for growth is what we should be discussing about—not science and technology for sustainability, social and environmental justice, plurality and you-name-it different kinds of justices that are missing out there today. Maybe because you are speaking with a group of public sector scientists, from the names that I gathered while standing here. Maybe it seems like a correct sort of a thing to discuss. But in a policy setting, which favors only growth, in a policy setting where every space is left to the private sector, how do you expect various other kinds of investments to take place? Coming from the field of agriculture, I would like to know who would invest in agroecology. It will not add to the GDP (gross domestic product) because people will not buy things in *dabbas* (packaged goods), pesticides will not be bought, fertilizers will not be bought, maybe they will use nature's processes, it won't add to the GDP. Maybe people will not fall sick. And maybe hospitals won't run. It will not add to the GDP. What do we do in terms of some of the real solutions that don't get adequate resources from governments that don't

think about actual plurality? May we see a situation where particular technologies are favored than particular other technologies? How do we explain this?

Jairam Ramesh: Kavita, I am a prisoner of the system. I told you right in the beginning. I am not questioning the assumption of growth. I am not questioning the paradigm of growth. I am not questioning the model of economic growth. All I am pleading for is that recognizing the growth imperative, how do you maximize ecological benefits? How do you maximize public confidence in that growth process? And how do you minimize the pains of the growth process—whether it is land acquisition, whether it is deforestation, or whether it is pollution. So I am not questioning the premise of this energy-intensive, resource-intensive model. I am not, because I am not a romantic. And I am not an anarchist. I am a realist. You know, you have to find jobs for 10 million youths who are entering the labour force every year. You have to generate 60,000 to 70,000 MW of power every year to meet energy demands. You need water. You know, I don't have to spell it out for you. So you can go the Schumacher route and question the entire model of growth. I know many of you might want to do it. But you know, I think if Gandhi lived today, Gandhi might have had a different viewpoint! Hind Swaraj was a product of 1904, it was a product of his times. I think you know the circumstances and the challenges in which we are living force us on a certain growth path. Electricity is essential, transportation is essential, jobs are essential, low-input high-output agriculture is essential. You have to feed people! And thinking that India is going to produce, 270 million tons of food grains with cow dung and cow urine, I think is romantic to the extremes!

Shiv Vishwanathan: Then don't talk about green growth! It is utterly hypocritical. Your argument is coming apart, at one level you are using the same causalities you accuse your opponents of. The way out is, you put back what you said. Because the minute a question is asked, you talk beautifully of green growth and then you say "I am a realist" as if you are competing with Montek Ahluwalia.

Jairam Ramesh: You know, I have often said Shiv has to be heard, he has to be read, but not believed!.

Prabir Purkayastha (*NewsClick and Delhi Science Forum, New Delhi*): I think between green growth and green capitalism, we must also be clear. I suspect that what you call green growth is green capitalism and in that sense, it is capitalism with a human face or the neoliberal economy of the human face. If that becomes an issue, then we really have problems. I do appreciate the fact that the scientific community in this country is not used to speaking to the people. And the whole tradition of the people's education in science, public communication of science—how to bring it back—is a big challenge for us. Otherwise, we will have a one-sided debate in which the scientists are going to lose, and lose badly.

Jairam Ramesh: Let me start with your last comment that scientists are losing the plot. They are losing the plot on nuclear, they are losing the plot on genetic engineering, they are losing the game on a whole variety of technical issues because apart from the fact you know, the civil society is well organized. Some of them get funding and the real issue is what you have put your finger on. Unwillingness and

the inability of the scientific community to come out, engage, not just communicate —engage! I find that to be the single greatest weakness.

Prabir Purkayastha: Jairam, this whole issue of foreign funding of NGOs is becoming a big issue. Now the question is Monsanto is here, Areva is here, we have an Enron over here and a lot of 'public education' within quotes. So don't blame Green Peace if you bring in all the others! Don't bring the opposition to Walmart if you bring in Walmart!

Jairam Ramesh: Let me tell you an interesting story about Green Peace that has not come out. A file came to me in February 2010 on Dhamra Port in Odisha saying that Dhamra Port which was being built by Tatas was actually forest land. They did not get forest clearance and this would lead to a massive, destruction of Olive Ridley Turtles. So I did my due diligence. Got all the files, got all the paperwork talked to all the officers who went to Dhamra, did a field visit. I came back and I recorded a two-page note, "Why Dhamra should get the clearance." Okay? 1, 2, 3, 4, 5 … Green Peace got hold of that through RTI (Right to Information), no problem, I have no hassle, they asked for it and I gave it. And before I know anything there was an advertisement in all the newspapers of India including *The Times of India, The Hindu, The Indian Express and Hindustan Times* reproducing my note and saying that I am an agent of the Tatas, that I have taken money from the Tatas to clear the Dhamra Port. Now, the accusation against me is that I have reduced GDP growth by 2.5 % points. Nobody has accused me of taking money from the Tatas. Greenpeace was the first organization to accuse me of clearing a project! Normally the accusation against me is over not clearing project. This was an occasion in which they went to town saying I actually cleared a project! Now, having said this, on Bt Brinjal, they made my life miserable. Even though my final product turned out to their satisfaction, during the process, they would sit outside my house, they would bombard my e-mail address, fill up my inbox with memorandums from all over the world, made my life miserable. So I have had a particularly rocky relationship with Greenpeace. But let me say this for the record publicly, I disagree with putting any form of restrictions on Greenpeace. I disagree with what they have said, I don't find their methods also agreeable at times, but you cannot choke off dissent like this, *yaar!* (friend!) These are people … you know, they are raising issues! And the government must have the courage and the integrity to address those issues! They used one of my reports on the Mahan Coal Field to raise issues. And Essar has filed a defamation case against them. I would defend Green Peace on that. So I don't think that we should reduce the great danger. I feel, in the next couple of years the room for dissent will shrink. The tolerance for different points of view will shrink. The growth mania will be accompanied by envirophobia, you know? And I think that is what we have to ward against and I will speak up for Green Peace publicly. I have already spoken up publicly. We should allow protest, we should allow organizations to have different points of view, and if it means delays in projects, so be it. But this type of fundamentalism that we will ride roughshod over all forms of protests and agitation, I think, will not

do justice to the growth process and it certainly will not make the growth sustainable, socially.

Pallava Bagla (*NDTV, New Delhi*): Mr. Narendra Modi (the current Prime Minister of India) seems to be following a lot of what you have said; Mr. Modi seems to be following very closely your footsteps. Are you enamoured and in love with him now?

Jairam Ramesh: In public life, you cannot take intellectual property rights on ideas or on words, there are many words I may have used which others have used. But yes, when I first said that Indian women have more mobile phones than toilets, women's organizations jumped on me. When I said that in India, toilets are more important than temples, VHP (Vishva Hindu Parishad) and RSS (Rashtriya Swayamsevak Sangh) came and urinated outside my house. But when Narendra Modi said, "*Sauchaalay, Devaalayon se bhi zyaada mahatv rakhtein hain!*" (Toilets are more important than temples!), big deal, *yaar!* (friend!) I mean he has recognized the value, all power to him. And I hope something comes out of it. On environment, I am not sure. He says that environment should be integrated with growth, but in actual practice, if that integration means making choices, which means no dam on the Ganga, or which means no coal mine near tiger reserve, then I am not sure that Mr. Modi will follow what I would recommend. So I am not sure. And third, the difference between him and me is I am far more comfortable with Green Peace than he will ever be. I am far more comfortable with the Kavita Kuruganti's, I don't know for how many years she has been arguing with me. We disagree on most things. But you know, we have a most agreeable relationship here. I don't think Mr. Modi is capable of that.

Pallava Bagla: The Intelligence Bureau report, which we are talking about today, came out at the time when your government was in power and Mr. Manmohan Singh was the Prime Minister, and he himself said in an interview, very sharply against whatever is being said. So it seems to be going across governments. So, I don't think Mr. Modi should be blamed for that. Equally, if the blame has to go, it has to go to both UPA (United Progressive Alliance) and the NDA (National Democratic Alliance) for not wanting dissent.

Jairam Ramesh: Intelligence Bureau is a contradiction in terms, you know? It is an oxymoron. It is like military intelligence—they don't go together! The amount of intelligence that is shown in this report indulges not in casual empiricism, but spurious empiricism. There is empiricism of a casual variety, but there is empiricism of a spurious, and a bogus variety when it says that India's GDP has been reduced by 2–3 % points. First of all, I don't know whether it is 2–3 % or 2–3 % points. There is a fundamental difference between the two, which will go beyond the IB capability to comprehend. But you know, they say that India's GDP has come down 2–3 % because of environmentalism. How do you get this estimate? Who has done this estimate? Where is the data? Why is it not in the public domain? Why is it not peer reviewed? It is another Himalayan glacier type of a bogus

statement, you know? So if the IB (Intelligence Bureau) has done some path-breaking econometric analysis, let it be out in the public domain. Let it be debated. But you cannot, on the basis of innuendo and insinuation say that Indian environmental activism has reduced India's GDP by 2–3 % points. It is bogus, *yaar!* (friend!) It is bizarre and bogus!

Parthasarathy: I just don't want to join issue with you, I was in the first environmental Ministry of Environment Committee for nuclear projects. When one of the power projects was considered, they had put 40 conditions not 36! And some of them were, you know very loose. Again, as you said, now the way it was put, you know okay, let us have more conditions added. And I was responsible for putting one condition, a very innocuous condition that "In addition to the MoEF (Ministry of Environment, Forest and Climate Change) conditions, AERB (Atomic Energy Regulatory Board) conditions also should be fulfilled!" So, I am sorry you need not take credit for putting 36 conditions in the case of Jaitapur because 25–27 years ago, probably in 1986 or 1987, when the first environment MOEF Committee worked on it they had already put 40 conditions. Now, I didn't look at these conditions, your conditions and their conditions. So you are not escaping by putting conditions that was what I was telling you.

Jairam Ramesh: Yeah, conditions are what Shiv would call a "cop out", you know? Yeah, it is a cop out, in a way. You have given me an interesting thought I will get back to you. I will compare those 40 conditions with these 36 conditions. These 36 conditions, we tried to make them as site specific as possible and I suspect, I might be wrong Mr. Parthasarathy, but the 2010 conditions, would have more to do with ordinary people's concerns about resettlement, rehabilitation, acquisition of lands, rise in temperatures and loss of livelihood, those types of issues. So, I suspect that there is some difference between the two.

Srikumar Banerjee (Former*Chairman, Atomic Energy Commission of India*): I don't want to go into the Jaitapur issue because a lot has been discussed. I just want to make one statement that you made regarding the expectation that how much would be the nuclear contribution. I think, a kind of a wrong perception prevails on this because Indian Government has never committed to install reactors to generate 10,000 MW by 2000—it is from a power point presentation by a chairman earlier—that is all! Because it has never been a sanctioned project, it is not a government policy. So if the government investment is not there, there is no way you can get that done. I think it is a wrong notion. Actually whatever has been committed by the government in the form of a sanctioned project, I think there is not a single one where one can say that there has been a failure.

Jairam Ramesh: Well, you know Dr. Banerjee, my first job in the government was in the advisory board on energy. And one of the first things I sat through in that was a presentation by Dr. Raja Ramanna and Dr. M. R. Srinivasan, who made a perspective plan for nuclear energy: 10,000 MW by the year 2000. That was not government policy. I agree with you. It was a perspective prepared. Then it became 10,000 MW by 2010, then it became 10,000 MW by 2020.

Srikumar Banerjee: In many minds this is there. See, technically I am not talking about sustainability. If today we talk of sustainability involving thorium, immediately the question will be that thorium we have been listening from Homi Bhabha's time. So why thorium is not in action today? Now this has a technical bearing. It has nothing to do with Bhabha has told or not. It essentially depends on whether you have installed several fast reactors or not. Like you mentioned about the cancer cases around, I have given exact data surveying over 150,000 people. So that is why there are perceptions. It is like where you get the maximum deformities? Around the places of worship; so you wouldn't associate these deformities of people with the shrine. It is the same kind of logic.

Jairam Ramesh: It is a very interesting analogy.

Prabir Purkayastha: A simple point I would like to make that you know, one of the reasons for nuclear programme got into problems was uranium mining. Funds were cut and the two people who were responsible for cutting that were the then Finance Minister Manmohan Singh, and Montek Singh Ahluwalia, who was the Finance Secretary at that time.

Srikumar Banerjee: The issue is that we really pay a very heavy price for uranium in our country because we are having an ore which is as low as 0.03 to 0.04 % in uranium content. This is not considered to be an economically exploitable material. But Homi Bhabha decided way back to open a mine in 1966. You see the wisdom of that. Only because of that India has independence in the overall nuclear activity. Otherwise, we would have perennially been dependent on import of uranium. So there are issues of this kind; so it requires one-to-one discussion.

Jairam Ramesh: Sure.

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