

Science and Society: The perspective of an Indian woman scientist

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It is best not to take oneself too seriously if one is dealing with a rather serious subject, and wishes it to be taken seriously; it is in this spirit that I would like to start my talk with a light-hearted anecdote, which nevertheless illustrates three of the main points that I will touch on during its course.

When, as a young post-doctoral researcher, I was trying to pioneer a new field of research (the physics of granular media, or more colloquially, the physics of sand piles), I came across various reactions to this. Let me attempt to classify these under the more solemn subheadings of my abstract:

1. (Dis)respect for gender identity.

I was frequently referred to as 'that sand pile woman', which conjured up visions of a laid-back woman lazing on the beach, dabbling in sand. The implication in most such cases was that only a dilettante would dabble in a subject as frivolous as sand, and of course as a woman, I was more than likely to be not completely serious in my pursuit of the sciences. I am sure that my love of subjects outside the sciences, such as music and literature, only added to this perception in certain scientific circles, of an essential light-hearted- (and alas, light-headed-) ness!

2. (Dis)respect for gender/cultural identity / Links of the enlightened across countries/ genders.

As time went on, and I was exposed to more and more seminar audiences as an invited speaker, I occasionally had to confront somewhat hostile ones, as do we all. However, it was in fact a French (male) colleague who on one memorable occasion alerted me to the fact that sections of the audience were PLANNING to be confrontational at an invited talk for one of the European Gordon Conferences. His advice to me was to shine the laser pointer into the eyes of those people who tried to heckle me! – although in the end I did not need to resort to this somewhat extreme option, I did tackle the hecklers appropriately, much to the relief of my colleague.

After my talk was over, my colleague asked me why I had been a target for heckling: after all, he said, I had given a sensible talk, and a man in my place would not have been similarly targeted. Was it, he asked, because I was an Indian, or a woman? My reply was, none of the above: my real crime was that I was unprepared to apologize for being either...

3. Rights of authors.

This story does, however, have at least a partially happy ending. The field I was trying to publicize was in fact taken very seriously within a couple of years, and many of my early ideas soon gained reasonably wide currency. The fact that they were/are not normally ascribed to me is, I feel, a small price to have paid for this.

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I apologize for this rather personal introduction, but much of what I will say has been informed by my personal experience as an Indian woman scientist. Of course, it has been fed by the experiences of those who are Indian scientists, but not women, or those who are women scientists, but not Indians, which is why there is a certain universality about the admittedly

personal observations in this talk. I should also add that the reason why I am giving this talk in such a distinguished forum is that I am now personally easy about its subject matter; put simply, I am older than I used to be, and this is at least in part the reason that I need to struggle far less than I used to have to, in order to be heard. This on the other hand puts on me a responsibility to be able to give voice to the problems of those suffering gender/racial biases which are still ongoing, whose continuing bitterness would not allow them to be taken seriously in a dispassionate forum such as this one. It has also been my good fortune to forge very strong alliances, across the gender/ generational/ racial spectrum, which have helped me to overcome hostility at a personal level; at a collective level, these links have allowed me to be heard with empathy by those whose life experiences on the other side of various divides have been rather different from mine.

Let me repeat the question that my French colleague had asked, in a more impersonal way - why are women, and/or people from developing countries treated less seriously in an academic forum (of which science is one, but not a unique example) than a man and/or someone from the developed world would be? Let me add another question:

why, in most of the seminars that I attend as a practicing physicist, are many women afraid of asking sensible questions, when many men are not afraid of showing their ignorance rather loudly, or to ask questions which can be paraphrased as 'I ask, therefore I am'? (In the following I will use quotes to denote 'women' as shorthand for women/people from developing countries, with in turn 'men' denoting men/people from developed countries).

Now, instead of giving the stock answers that are usually produced at this point, let me say that we ('women' as defined above) are late starters in science, and naturally have not had the cumulative time required to put us as easily at par with our 'male' colleagues. I will admit that just as one is more likely to find students ready for Oxbridge in elite public schools in England rather than in comprehensive schools, one is perhaps more likely to find more natural scientists, trained to perfection in their objectivity, among 'men' than 'women'. However, even in this probabilistic scenario, it must be conceded that there might well be some deserving 'women' who have clambered up a rather difficult path and attained a point of some professional visibility. Their reluctance to ask questions at other peoples' seminars, or the audience's still slightly patronizing responses to their own seminars, can only be put down to the mindsets of the audience, which are conditioned (unconsciously, in most cases) to suspect their intellectual training.

This is based largely on the following reasoning: given the late starter phenomenon in science, more 'women' than otherwise would be likely to be weak in their conceptual backgrounds in science, thus more 'likely' to give ill-conceived talks, to ask questions based on misunderstanding.

However, there is also a question of cultural or gender-based diversity. There are ways of self-expression that are unique to 'women', that are distinct from 'men' - for example a certain enthusiasm or impulsiveness of expression is rather more common, even in scientific talks, to people from tropical countries, or to women (regarded as women rather than as 'women'), which carries no external value, and is no more or no less indicative of the content of the talk than the more stony-faced countenance typical of more temperate climes, or of men. Unfortunately the vast preponderance of the latter among the rungs of successful scientists has created an image of the 'scientific countenance' where scientific objectivity is sometimes linked to a neutrality, or even a lack, of expression and expressiveness.

What are the ways out of this situation?

Equality of perception is clearly the objective, but this is not a solution; one needs to suggest the means of attaining this equality.

An oft-suggested and sometimes implemented remedy has been affirmative action. However, even as a person who is a 'woman' both from the gender and the racial points of view, I have strong reservations about this. First because it only adds, however unfairly, to the perception

of women as 'weaker' - thus even a woman who has justifiably made it to the upper echelons of science research or administration, without the need for affirmative action will, in an institution where affirmative action would normally be implemented, be seen as someone who was pushed up unfairly against a more deserving male candidate. In her professional interactions, she will have a greater degree of explicit or unstated hostility than she would in an institution where there was no affirmative action. Since the point of affirmative action is at least in part to eliminate such prejudice, it is then counter-productive, since NO appointments of women, however deserving, would then be immune to hostility and doubt.

The second point is that, in order to be eligible for the benefits of affirmative action, the 'woman' concerned must have attained at least some degree of visibility; if she then NEEDS to have the extra leg-up of affirmative action, she is likely not to be deserving of it. An example that comes to mind in this context concerns the admission of students to medical colleges in my country about twenty years ago. Special reservations were made for students of low caste or students from villages: however, the upshot of this was that rich and rather undeserving students of intermediate or low caste were able to use the regulations in their favour to gain admission to medical colleges. A couple of instances will illustrate this: one concerned the daughter of a very influential Central Government minister (himself a token appointee for his 'low' caste), who was, as can be imagined, extremely well connected; her low marks notwithstanding, she gained admission to one of the most prestigious medical colleges in the country, because she was able to use the 'caste card' as well as the 'woman card' in her favour. Another instance was when a friend, resident in my city, used her father's country home in the suburbs as her legal address, to apply for admission to a medical college – which would have been refused her had she applied from her real city address. A rather unfortunate throwback to all of this can be seen in the recent trend in my city, where doctors whose graduation dated from about twenty years ago, and who have low-caste surnames, are avoided, not because of caste prejudice, but because their clientele assume (often wrongly) that they were undeserving beneficiaries of affirmative action!

Finally, on this topic, I would like to say that those 'women' who succeed deservedly do often have to be three times as good as the 'men' around them, given the state of society - there is a feeling then of insult being added to injury when they too are brought within the general ambit of suspicion caused by affirmative action, when they would perhaps be far too proud ever to have considered availing of any such consideration, when they would typically want to be considered on their merits alone. The only affirmative action that I think is generally free of these drawbacks is that which is implemented at inception; at the school level, for example, girls, or people from the developing world, or low castes, or poor people, should all have the same opportunities - but of course this needs a utopian world!

A second possible, if partial, solution is freedom of circulation. For example, exchanges between the developing and the developed world, or the ability for women to be trained in male-dominated scientific environments via hand-holding programmes, could be seen to provide avenues for freer professional development, for the liberation of both 'men' and 'women' from traditional mindsets. This is of course a good, as well as an ongoing method of solution – but not one without its problems, the most obvious one being that it causes a brain drain. It is difficult for people who have made the transition from being perceived as 'women' in science to being 'men' in science, to return to situations where these perceptions would be reversed. Once again, I speak from personal experience as an Indian woman scientist who took the decision to return to my roots after 17 years in the west, and at least initially encountered problems of perception both in India and in the west. In the case of certain colleagues at home, and to do with many instances apart from my own, there were jealousies associated with education and training in the west, and claims were even made that these long stints abroad were the reason that our papers continued to be published in reputable journals after our return!

In the case of colleagues in the west, there was at least for an initial couple of years, a feeling that a return to India would diminish one's productivity, a feeling that this was associated with the

environment rather than the individual: if, then, a 'woman' returned to an environment of 'women' both in the gender and in the racial sense, would not her future productivity be doomed? In both cases, once again, it was freedom of circulation, which corrected some of these perceptions; although based in India, I and many returning scientists like myself, continue to be associated with western institutions of research, which we visit regularly. I should mention that the role of the UNESCO-funded Institute of Theoretical Physics at Trieste, set up precisely to promote free circulation of scientists, to reassure them of continuing contact with the west, and thus to counter the brain drain, has been utterly crucial for this. More and more scientists in India, for example, now choose to return to good places in their countries rather than, for instance, opting to stay on in second-rate places in the west; this trend has led to a growing perception of India as a scientifically developed country. Freedom of circulation has in this sense brought about a partial success story; scientists from at least some parts of the developing world, are beginning to be taken as seriously as their counterparts in the developed world. In this sense, at least some 'women' are benefiting in perceptual terms, although the women among them may not always be as lucky.

There is also another, somewhat subtler, problem; 'women' or more generally minorities who have been able to climb the professional ladder are sometimes less than sympathetic to those of their kind who are starting the same process; partly in a desire to conform to the establishment (to become 'honorary men', in some sense), so that they are viewed as part of a suitably defined 'old boys' network', and partly because of a sense of insecurity that the next incumbent might be more successful, occupy more of the limelight, than themselves, that the share of the visibility cake for each 'woman' might decrease as more and more 'women' make it to professional success. This is often viewed as a typically female trait by uncharitable male critics, but I would like to emphasize that I have seen this trait exhibited as often by successful men from developing countries who have suddenly attained a position of prominence in the developed world; these are sometimes the worst impediments to the professional development of young people from developing countries, and their prior knowledge of the latter's backgrounds is often used to convince colleagues from the developed world of the unworthiness of the young aspirants in question. Despite these problems, however, it is clear that the maximizing of exchange between the different communities that I loosely label 'men' and 'women' is what, in time, will contribute significantly to the lowering of barriers, to minimizing the strangeness of one community vis-a-vis the other, to make for a better understanding of the complementary roles that all of us can play together in the pursuit of science.

In part this freedom of circulation is precisely what leads to the links of the enlightened across nations, genders and generations. Once again, drawing on my personal experience and that of similar individuals, it seems to me that there is in fact a network of people cutting across all barriers, who are instrumental in recognizing, and extending a hand to, another kindred spirit, no matter what the diversity of background in each case. These links are not just essential, it seems to me that they are possibly the only foolproof way of correcting false perceptions, of rooting into society in general more unbiased attitudes towards minorities or newcomers of any sort. This is possibly why I tend to regard with some reservations the formation of women-only societies in the sciences, which has become customary in some universities in the US, for example - these reinforce barriers, and by excluding the very people whose perceptions need changing, they are detrimental to their own cause. Even if the perceived militancy of such societies is able to ensure a couple of affirmative action positions, (and in any case it is not clear, for the reasons mentioned above, that these will go to deserving people), they will be regarded with suspicion and mistrust; while they might occasionally influence the actions of the majority community, they will never influence their hearts and minds, or in particular their perceptions. Links of the enlightened, formed typically personally and by coincidence, are, on the other hand, a real, if not a reliable

way of making progress; setting them in stone, or creating official societies for this purpose, is counterproductive since this takes away the element of spontaneity which can unite generations, genders and nationalities. Of course such random events (we call them stochastic processes in physics!), which depend on like-minded, people meeting each other in the right circumstances, are bound to be few and far between compared to those for which official channels exist; but given the demerits of officialdom, and given the divisiveness that results from making things mandatory, I think that such individualistic processes merit the patience which must accompany them.

At the basis of these 'networks of the enlightened' is of course universality; that word which conjures up what all of us think or sense or experience in unison when confronted with life's turns, irrespective of our respective backgrounds. In the context of this talk, this is what allows a man to believe that although the scientist in front of him is of a different gender, what she says 'makes sense', i.e. it is at one with his intellectual perception. Even where he may not agree with her scientific viewpoint, it is universality, which allows him to respect her intellect enough in order for him to accept that discussion or argument with, rather than dismissal of, a differing viewpoint, is in order. It is this that allows a starting scientist from a developing country to be respected by a senior scientist from a developed country, despite the obvious lack of training and experience in one case relative to the other. Once again let me draw on a personal experience to illustrate this point; as a starting postdoctoral scientist in Cambridge, I was somewhat in awe of my research supervisor, an extremely distinguished scientist with one of the most brilliant minds that I have encountered. What I had expected was that he would treat me with condescension and reserve, and in this I was wrong; his manner with me lacked any airs whatsoever, and, on the contrary, I felt that he provoked me on scientific and social matters wherever possible. My initial scientific discussions with him were characterized by his assertion that he didn't believe a word of what I'd said; however this was said without condescension, and with sufficiently much of a twinkle in his eye that I felt propelled, even emboldened, to defend my point of view. It was only much later that I realized that he used these tactics to sort the wheat from the chaff, that in essence he lost intellectual respect for those who did NOT challenge him, and who had no intellectual fidelity or consistency when attacked; and after we had established this 'equality' on the battlefield of ideas, I started, and continue to enjoy, a relationship based on close intellectual and personal ties with him. His method of establishing universality with his research associates, though based on a jocular 'dismissiveness', has been an effective one which has united generations, genders and nationalities, which has allowed him to interact closely with those who are far junior, far less trained than himself. It is clear that this happens because he senses a universality of intellectual perception, is able to imagine a unified scientific goal, across a plethora of social, cultural and scientific barriers.

This universality of perception, where it exists, is of course based on a respect for cultural diversity: it needs the liberty, liberalism and tolerance of an unfettered mind to imagine that not all originators of good scientific thought come from the same social, economic, sexual and cultural backgrounds. This freedom from prejudice is of course characteristic of the true intellectual objectivity from which all good science originates, and it thus usually characterizes those whose scientific research is outstanding; few outstanding scientists in one's experience are, as a result, grudging of the place they need to make for others, be they women or other minorities, who are deserving of acclaim. This is often a consequence of their own security of personality, where they are confident of themselves to the point that they do not question the integrity of others without good reason. On the contrary, it is often, unfortunately, those who are themselves discriminated against, who transmit this discrimination to people more vulnerable than themselves. Two examples, both from a social rather than a scientific background, come to mind: one concerns Mahatma Gandhi's statement when he was told that a certain villager (an untouchable, or 'Harijan', as Gandhi termed members of this caste) epitomized the lowest of the low in India, being poor and socially at the bottom of the pyramid.

No, said Gandhi, it was not this villager who epitomized the lowliest of the low in India, but the villager's wife....

The other example concerns the name of a popular telenovella in India, which translates as "Because the mother-in-law was also once a daughter-in-law", which epitomizes the conflict between the oppressor and the oppressed in India's very patriarchal society; in this case, this is done by drawing attention to the fact that the oppressor was also once the oppressed, that in a sense the worst oppressors are often those who have themselves been oppressed. Scientific analogues are easy to find: some of the worst misogynists in what is often thought of as the scientific fraternity are to be found in developing countries, where the combination of somewhat macho traditions in many cases, and the experience of racial discrimination from colleagues in the developed world, make for a lethal cocktail of insecurity and prejudice, leading to statements that are at the same time absurd and shocking. One such example concerned a conference organized in my country, where I was appalled to hear the chairman say as part of his welcome address, that his work with a certain female student was incomplete because, I quote, 'it had been a mistake to take her on'. We should all realize, he'd said, nodding sagely and with a rather comical insouciance, that female students would always up and marry at the first available opportunity, and give up scientific research as soon as this happened; they were thus, in his view, a deeply unprofitable bet when it came to conducting scientific research. This disrespect for diversity, in the gender sense, came from a man who, as I was later to find out, regularly attributed his lack of a good publication record, to racial discrimination in Western journals, to their alleged lack of respect for HIS cultural diversity.

The role of traditional attitudes and traditional knowledge is important to discuss in this context. While, especially in the biosciences, there is an increasing regard for traditional knowledge in what is now the developing world, the same logic does not necessarily hold for the physical sciences. Herbal remedies, which are part of traditional folklore in eastern societies, are now being patented in the west (an excellent example being the patenting of turmeric, long known for its medicinal properties in India, by an Indian-American company in the US), so that traditional knowledge in this area is a great asset to many pharmaceutical companies. On the other hand, apart from the much touted invention of zero, and some knowledge of astronomy, the ancients in the eastern world have not been a particularly fruitful source for ideas in the physical sciences. It is unfortunate, given this, that some of the (less successful) scientists in the developing world hold forth in print as well as orally, on how all of modern science was predicted by ancient eastern scriptures – the more erudite among them find support in the last chapter of Schrodinger's essay 'What is Life', which argues in favour of a connection between quantum mechanics and eastern philosophies, without realizing that even great scientists ought to be allowed their speculative moments in peace, without the need to have their every word weighed and taken as gospel truth.

The less erudite jump on every conceivable populist bandwagon without the need even for this minimal justification; once again two examples in my country come to mind. The first concerns a serious campaign some years ago by a number of 'scientists' to support the occurrence of a so-called miracle, when statues of the Hindu god Ganesha allegedly drank milk for the period of two days (rather coincidentally, this happened just after a 'miracle' in Italy when a Madonna allegedly spouted blood for two days - this coincidence has been attributed by skeptics in both countries to the speed of the internet); happily there was a counter-campaign by more rational scientists in India who countered these stories by introducing the ideas of capillarity to the general public, whereby porous materials such as clay can absorb quantities of liquid. The second, which is much more recent, is the deeply regrettable instance of the University Grants Commission in India seeking to introduce courses in astrology and palmistry as part of the educational brief of the basic sciences, when research funding in the more conventional sciences is being cut across the board from all scientific institutions. In both instances, it is scientists (of

whatever pedigree) who have proposed these unscientific projects, on the basis that traditional knowledge in older societies can still provide the forefront of scientific knowledge; in both cases, apart from the individuals' unfortunate beliefs, there is a cynical calculation that such proposals will find favour with the unsophisticated majority, and hence will please the politicians who rule us all. Another deeply regrettable consequence of such actions is that the idiocy of a few will taint the reputations of their compatriots, that developing countries will continue to be viewed as unscientific societies where voodoo and snake-charmers masquerading as 'traditional knowledge' guide the thinking of practicing scientists. While therefore not discounting traditional knowledge per se, I would appeal to rational people across national and gender barriers not to give traditional knowledge more than its rational due, and equally, not to judge entire nations by the arrant lunacy with which their senior functionaries, in some cases, trumpet the role of traditional knowledge in their societies.

Much of the same reasoning holds for traditional attitudes: despite the rather interesting trend in many developing countries of women forming a substantial fraction of science students, and even of college lecturers, there are relatively few senior women researchers in these societies. This trend of very few women in senior scientific positions is also common in many western European countries, and it is only gradually being combated in the United States through, alas, affirmative action. It indicates that social traditions in patriarchal societies (which are least present in some sense, in the US, because of an aggressive free-spiritedness and litigiousness in that part of the world) can run counter, even in the elite and supposedly objective world of the sciences, to the interests of women and minorities, and impede the free development of such talents as they might possess. Even where women or racial minorities are allowed to rise, they are often required to be 'docile', to be suitably 'grateful' to their male mentors; an unwillingness to behave in these ways has caused more than one among my women colleagues in different societies to be accused of being 'too independent', an interesting turn of phrase which I have never heard applied to a man. Also, questions during scientific seminars, which would be regarded as incisive and intelligent by men, are, across national barriers, regarded as aggressive (for that, also read unfeminine), in a woman. Once again, it has to be admitted that societies, which are referred to, somewhat disparagingly, as 'having no traditions or cultures', or being 'new societies', are precisely the ones, which are the least guilty of afflicting their minorities with prejudicial baggage. This is not to disregard the importance of traditions or traditional attitudes in scientific or social matters in any society: but simply to say that the unthinking application of many traditional proclivities can lead even in the abstruse practice of the sciences, to anachronisms that are unworthy of the scientific spirit.

The scientific spirit is, and should always remain, characterized by an openness of outlook, a freedom of inquiry, a curiosity, which goes beyond conditioning and prejudice. This after all is how nature is probed in all her complexity, since prejudice would reduce our research to the level of superstition; mythology is based on preferred views of how life originated, while cosmology takes a more objective stance. When transferred to the realms of human interaction, this attitude demands the absence of prior expectations based on the racial or sexual origins of a colleague; this is why the prevalence of discrimination, however subtle, is far more glaring or painful in our field than it would be in one where subjectivity is allowed to play a legitimate role, such as where market forces are involved. Part of the scientific attitude, again by contrast to industry or market-related endeavours, should also involve a freedom of research, where research directions can lead to arbitrary results. This is where, ironically enough, developing countries still allow for 'basic research' in a way that is getting increasingly difficult to do in more developed and product-oriented societies; I find for example that I am less harassed by my superiors to get grants from industry than my colleagues are in Britain and the United States (France has always been a bit special in having the CNRS system, and long may it retain this!), when they typically have to appeal, however falsely, to a

technological product, in order to explore certain basic research directions. Of course the reason for this is not a greater open-mindedness on the part of Indian bureaucrats, but the rather sadder fact that industry is not as developed in the developing world by definition, and that industrialists in the developing world are in general rather less open to having scientific research as a part of their sponsored activities. However, a relatively fortunate consequence of this sorry state of affairs, is that in general there IS freedom of research in developing countries, even if the requisite facilities (such as libraries or computers) are often locally unavailable.

These facilities, can, however, be shared across unequally balanced societies, thanks to the Internet - this advance in technology has probably been the largest single factor in recent years which has contributed to the leveling of the playing field of scientific research. With the access to information that is freely available there, with the advent of scientific archives where authors make available their most recent results without the need for subscription to expensive journals (which can be prohibitive for institutions in the developing world at the current rates of exchange) to colleagues across the world, knowledge can be shared without regard for whether one is in the developed or the developing world, and even facilities such as computers are available online for international collaborations. My own scientific collaborations necessitate long computer jobs in places as far distant from Calcutta as Vienna, Norwich or Paris, so that in this sense I am far more immune to the non-availability of sophisticated computers in my home institute than I might otherwise have been - this, I emphasize, is not specific to me, but is rather characteristic of the inclusive spirit of modern science, one of the ways in which 'women' and 'men' are beginning to be part of the same club in collaborative terms. This is leading to an international 'society of knowledge', where new methods of generating and disseminating knowledge via the internet are leading automatically to more social mixing between the erstwhile haves and have-nots, the 'women' and the 'men'. Apart from such cooperation being a very positive thing in itself, it is leading, certainly among the younger generation of scientists, to less prejudice based on gender or race. It is extremely common for instance, for a scientist based, say, in Calcutta, to communicate by email with a colleague in Europe, based on a recent publication in an archive - either to bring to his attention the former's own work in a related area, or to suggest a collaboration with someone he has never seen and might not normally encounter. Both the access to knowledge, and the ease of communication through the internet, have in this and other ways played an unimaginably large and positive role in the overcoming of barriers, to an extent that more personal interventions might have done only over a far longer timescale.

This 'society of knowledge' however, does come at a price. One can very easily imagine that easy access to others' ideas might tempt the un- or under-scrupulous to plagiarize, and this too, does happen. The rights of authors are frequently overlooked when information is readily available on the internet, and people who run large scientific empires often genuinely forget whether they thought of an idea or came across it in an electronic preprint on the internet - this forgetfulness is enhanced when the real author of the idea is relatively unknown, of course. Once again, the primary casualties in such cases are usually the have-nots, or the 'women' (in this case I mean specifically people from the developing world), whose lack of visibility at international conferences is an impediment to their recognition, and does not easily lead people to believe that they would have the potential to generate good ideas. There are many cases where ideas have simply been taken over, wittingly or unwittingly, by large groups in the developed world, from originators in the underdeveloped world. A quote from William James comes to mind: "First, you know, a new theory is attacked as absurd; then it is admitted to be true, but insignificant. Finally it is seen to be so important that its adversaries claim that they themselves discovered it". This has been the research experience of several colleagues from developing countries, to the best of my knowledge. However in a sense this dishonesty is unavoidable, in the same way as all other sorts of fraud are; one would wish fraud not to be prevalent in a scientific society but fraud, alas, exists everywhere, and at all levels. Also, it is not as though the internet has made such fraud any easier (though it may have made it quicker!); plagiarism existed even when journals were the only

means of communication, and at least the internet provides an easy way to try to rectify genuine errors. Most young scientists of my acquaintance (in both the developing and the developed worlds) spend a substantial portion of their day reading the scientific archives with the stated or unstated aim of getting themselves correctly cited, in case errors of reference occur in new papers submitted for publication. The extent to which they succeed is in obvious proportion to their importance as scientists, as people that their rivals would not wish openly to alienate.

However, in all of this, I would not wish to be seen to imply that the only instances of scientific fraud are perpetrated by the developed world on the developing world (i.e. by the 'men' on the 'women'). Human nature being what it is, people will get away with whatever they can, wherever they might be. Amusing instances abound of publications in little-known (and even less-read) journals in the developing world, which write out by rote solutions to problems that were solved in the last century, in the developed world. This is NOT because the authors are unaware of their prior existence, but because this sort of plagiarism of the dead will not earn the wrath of the latter, and in the often fulfilled hope that the editors of these redundant journals would be unaware of common textbook knowledge. My point is that such plagiarism, while deplorable, is rather pathetic, does not detract from the achievements of the real authors, and does not really even benefit its little-known perpetrators substantially; plagiarism in the opposite direction, however, when a deserving scientist from the developing world (a 'woman', to use my earlier terminology) has a stellar idea taken from him/her and recycled as coming from the developed world (i.e. from a 'man') does far greater damage. (Let me also emphasize here that plagiarism is equally rampant between 'men' or between 'women' themselves, although I am highlighting only inter-species plagiarism for my present purposes). The rights of authors, given the open availability of information in contemporary society, are among issues that need far more attention paid to them, in particular to some of the asymmetrical situations that can and do develop as a direct consequence of new developments in communications, new ways of producing and disseminating knowledge.

In the above, I have tried to delineate some of the ways in which racial and sexual discrimination still manage to intrude into what is often perceived as the dispassionate and objective world of the sciences. However, I believe that there are indeed ways in which, given goodwill on all sides, they can be avoided or at least minimized. Such revolutions in attitudes must and will be gradual, if they are to be lasting; these slow processes will demand enlightened self-interest on the part of the majority community (the 'men'), patience on the part of the minority community (the 'women') and perseverance on the part of the networks of the enlightened which link both worlds. It is to be hoped that the new society of knowledge resulting from transcontinental collaborations between the 'women' and the 'men' of science will form the fora where such revolutions will happen naturally and peacefully, accompanied by grace, goodwill and intelligence on all sides.