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Promoting a Global Culture of Science

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Basic scientific research is largely limited to the West. Original scientific contributions by the rest of the world are extremely limited, though China, South Korea and India are beginning to make their presence felt. This absence of scientific research is largely due to the undeveloped state of scientific culture. To counter this, systematic and rigorous theoretical training of talented minds is crucial. That requires close interaction with the West. The author suggests various ways to do so.

Several recent studies and rankings of universities show that many parts of the world are conspicuous by their absence in the world of science. Of the world's top 200 universities, none is from Africa or from just over 40 Muslim-majority countries. Hardly any are from Latin America either. None of these countries is known for its contribution to basic science or for its technological innovations. Until a few years ago, this was also the case with South Korea, China and India. Happily China and South Korea are beginning to emerge as major areas of innovation, although not yet as centres of basic research.[1] India has longer to go before it becomes a significant presence in the world of science. Like China, it has made noticeable technological advances, but not yet in basic research. Singapore and Hong Kong are attracting attention, as are Brazil and Israel, but they too are not yet significant players. If we were to ignore these half a dozen countries, the rest of the world remains a more or less empty terrain, a passive consumer of science and technology developed in the West but not a contributor to them. Should this be a matter of concern to us? Some think it should not. In their view science is global in its reach, and it should not matter where it is developed. Or they believe that some societies are better at science than others, and that is an inescapable fact of life. I think they are deeply mistaken. The relative absence of scientific research in large parts of the world should concern us greatly for at least three important reasons.

First, unless we make the absurd racist assumption that intelligence and creativity are limited to the West, there is clearly a large body of untapped talent in the rest of

the world. We know that when some young people from Africa, Latin America and elsewhere find their way to good scientific institutions at home and abroad, they show remarkable creativity. If many of their countrymen were given similar chances, they too would prove a valuable asset both to their countries and to the global world of science. Understanding our infinitely complex and fascinating universe calls for all the intelligence we can muster, and having large parts of the world remain outside this exciting human adventure represents a tragic and avoidable waste of scarce and vitally important intellectual resources.

Second, like any other form of inquiry, science benefits from a dialogue between different perspectives and ways of thinking, each bringing its own insights and challenging the assumptions of others. This is particularly the case with biological and social sciences, although it is not limited to them. The human body and its workings, for example, can be understood in several different ways, and each of these suggests new ways of defining health and dealing with ill-health and diseases. In much of modern biological sciences, the body is treated as a self-contained object of investigation, detached from the mind and the natural environment. The Indian and, to some extent, Chinese medical traditions see these three as forming a unity, and define health and ill-health quite differently. They bring new perspectives to biological sciences, and a critical dialogue with them benefits scientific inquiry.[2] Although they have their limitations, which should be explored and exposed, these traditions challenge conventional Western assumptions and stimulate new areas of inquiry. Some of the creative ways in which Indian scientists are beginning successfully to integrate the traditional Indian with the modern Western approach is a good example of this. Even when other traditions do not bring new insights, they force us to become aware of our uncritically taken-for-granted assumptions and to defend them. The resulting critical self-consciousness is in itself a great gain. Developing the culture of science in other parts of the world also expands the scope of scientific research by placing the currently neglected third world problems and diseases on our agenda, and makes science less ethnocentric and genuinely universal in its goals and sensibility.

The third reason why the cultivation of science in other parts of the world should matter to us has to do with the importance of science as a valuable human good. Science represents disciplined reason, reason regulated by certain procedures and methods that are designed to help it answer its characteristic questions. It obviously does not exhaust reason, because there are also other forms of reason such as the philosophical, the moral and the historical that function differently. It does not exhaust all valid forms of knowledge either, because there are ways of knowing that fall outside those typical of science. That does not however detract from its importance as a distinct form of reason and knowledge. It is concerned with carefully assembled and assessed facts, establishing causal and other

connections between them and offering a theoretical account of them, and it represents a most valuable cultivation of the human mind. It teaches us to probe below the surface, respect facts, reason rigorously, think for ourselves, to accept nothing on blind trust, to ensure that beliefs do not outpace evidence, and so on. This way of thinking does not remain confined to science, and spreads to the wider society, permeates its public and private discourse, shapes its culture, and becomes an integral part of the way ordinary men and women think. This is evident in the way in which the modern western mind has been profoundly transformed since the 18th century not only by the new facts discovered by scientists but also by the way they think and reason about them.

Since science is a vital human good, we have a duty to promote it within the limits of our ability and resources, in just the same way that we have a duty to promote such other great goods as liberty and human well-being. A society without science is as impoverished as that without literature, the arts and philosophy, and is one in which human beings cannot rise to their full potential. To avoid misunderstanding, it is important to distinguish between science as the sole basis of culture and science as its important component, between scientific culture and a culture of science or rather a culture hospitable to science. In the former, science claims the monopoly of reason and colonises and distorts other forms of knowledge; the latter values science without violating the integrity of other valuable forms of reason and knowledge. The former is as much to be avoided as the latter is to be welcomed.

If what I have said so far is correct, we have both a moral and a prudential obligation to promote a global culture that is hospitable to science. It is a moral obligation because we should nurture human talents and create conditions conducive to the good life, the scientific inquiry being one of these. It is a prudential obligation because a global culture of science serves our enlightened self-interest. It benefits scientific inquiry by introducing a plurality of voices, and helps create a world less prone to the frenzy of irrationalism and the manipulations of malign and obscurantist interests.

The duty to promote a global culture of science raises two questions. First, what are the conditions of its development? And second, how best can we promote them? I shall take each in turn.

The scientific inquiry as we know it today requires certain material and cultural preconditions. As the history of its development in Europe and later in the US and Japan and more recently in China, South Korea and India demonstrates, modern science is closely bound up with industrialisation, which simply cannot come about and be sustained without technological and scientific research. A country embarking on industrialisation might of course parasitically borrow its technology from abroad but not for long. Some of its problems are bound to be unique to it, and cannot be solved by borrowed technology. Other countries might restrict the export of technology out of real or imaginary fear. Borrowed technology gives one no advantage

over one's rivals. National pride and self-respect too play a role. Thanks to these and other factors, countries embarking on large-scale industrialisation tend to encourage indigenous research. Some degree of material prosperity is also essential for scientific research. It generates an economic surplus needed to maintain a body of scientists devoted to apparently unproductive activities, and to provide them with the technical and other facilities they need to carry on their work.

While these and other material conditions are necessary, they are not by themselves enough to foster a culture of science. Two cultural conditions are equally important, namely a scientifically trained intellect and an environment conducive to free and cooperative inquiry. As I argued earlier, like philosophy and history, science represents a particular way of thinking about the world, asking certain kinds of questions about it, and going about answering them in a particular manner. It problematises the obvious, that is, sees what appears self-evident or natural to the innocent eye as a puzzle, a source of wonder, and asks what it really is and why it is what it is. It involves precision of thought reflected alike in its vocabulary and method, a careful formulation of the problem, establishing systematic causal and other relations between different phenomena, and testing, falsifying and hopefully developing an explanatory theory. Science begins and ends with theory, and its central concern is to develop an explanatory theory of the relevant subject matter. In this important sense it requires a particular kind of orientation of the intellect, in just the same way as do history, philosophy and other forms of inquiry. Unless the intellect is trained to think in appropriate ways, it simply cannot embark upon a scientific inquiry. Science is not what goes on in the laboratory. It is what one takes with oneself to the laboratory and what one does with what one finds there. Individuals can be taught scientific theories and how to design and conduct experiments, but these remain a scientific equivalent of rote learning unless they are also taught to ask probing theoretical questions and imaginatively explore new way of formulating and answering familiar questions.

The second cultural condition, namely a climate of intellectual freedom and criticism is just as important. Science is inherently public in the sense that it requires submitting one's ideas to the scrutiny of others and revising or rejecting them when they fail to survive it. Contrary to what Karl Popper had argued, science does not require democracy or 'open society' in the sense of freedom of expression and disagreement in the society at large, as the cases of the erstwhile Soviet Union and China show, but it does require freedom of inquiry and criticism within the scientific community. Unless the scientists are free to criticise each other and the prevailing body of knowledge, and to accept and reject ideas on their merit rather than on the basis of the authority and status of their proponents, the scientific inquiry cannot get off the ground.

Industrialisation, material prosperity, etc, are large historical events about which scientists qua scientists can do little. However they can do much to foster the

cultural precondition of science, and hence I shall concentrate on them. One of the most important factors responsible for the absence of scientific and technological research in large parts of the world has to do with poor scientific training. Intelligence is not in short supply, but it is not fashioned into a scientifically trained theoretical intellect. Students are taught basic scientific knowledge and how to perform routine experiments, but not to ask probing theoretical questions, to problematise the obvious, to think outside the box, to bring their imagination and creativity to their subject matter. They need to be trained, and that requires both a systematic exposure to finely trained minds setting examples of creative research and a stimulating environment in which one is constantly required to think for oneself and meet high standards. This is why young and talented students in the developing countries, who at best produce only pedestrian work, are remarkably transformed into promising scientists when given the opportunity of training at distinguished scientific institutions at home and abroad.

Thanks to a contingent concatenation of several complementary factors, modern science has fully developed in the West. This does not at all mean that the West is intellectually superior to the rest of the world. In earlier periods India, China and parts of the Arab world were centres of advanced learning and attracted scholars from much of the rest of the world. And some of their ideas and inventions significantly contributed to the birth of modern science in the West. No national or 'racial' pride need be hurt in acknowledging the current scientific superiority of the West and benefiting from it.

It is hardly surprising that students from the rest of the world blossom when given the opportunity to train in the West, and that the research-minded among them opt to stay on rather than risk stultification at home. It is striking too that those universities in China, South Korea, Singapore and Hong Kong that are often ranked among the top 200 have a significant presence of Western scholars and scientists or those trained in the West for a prolonged period.[3] The National University of Singapore, placed 22 in one respectable world ranking order, has an international faculty score of 94. Hong Kong University, ranked 41, has the international faculty score of 82. The Hong Kong University of Science and Technology, ranked 43, has the score of 93. Tsing Hua University, ranked 62, has the internal faculty score of 25. Beijing University, ranked 15, has the score of 7, which gets much higher when western trained scientists and returning expatriates are taken into account. All these universities have freely recruited Western scientists and scholars and well-trained expatriates.

For all kinds of reasons that we cannot consider here, India chose to be self-sufficient and avoided recruiting Western scientists. It is striking that no Indian university, with the exception of Jawaharlal Nehru University, appears among the top 200, and the latter only just makes it. The Indian Institute of Technology is ranked 50, but largely because of the superb quality of its students and teaching

and not for its research.[4] As Dr Bhattacharya, Director of the Tate Institute of Fundamental Research in Mumbai puts it, the 'biggest bottleneck in Indian science' is not lack of money; 'it is a lack of (trained) people and a lack of ideas. The human resource crunch is the simple biggest difficulty that India faces.'[5] The Indian government has at last realised this, and is rightly setting up 14 world class universities, all committed to attracting the best faculty from abroad for short or long term appointments.[6]

The West then enjoys a unique historical advantage, and has a great historical responsibility to promote the global culture of science. In recent years it has impacted on the rest of the world in three ways, namely through its multinationals, returning expatriates, and universities and specialised scientific institutions. I shall take each in turn.

Multinationals are outsourcing scientific research, and this has had both desirable and undesirable consequences. They train and retain local talents and arrest the brain drain. Sometimes they even reverse the brain drain by attracting expatriates. They encourage partnership between universities and industries, foster a culture of innovation, and set examples of how to build institutions conducive to scientific and technological research. Multinationals however also have their disadvantages. They are hungry for results and commercial spin-offs, which limits the kind of research they encourage. They also tend to foster 'blue collar' research; that is, adopting work done in the West to local conditions rather than generating new research. They also entice away talented academics from universities, with the result that the latter have fewer talented scientists and are reduced to teaching institutions of variable quality. The disjunction between teaching and research means that large bodies of university students receive no or poor research training, and society as a whole fails to develop both a scientific base and a culture informed by the scientific spirit.[7]

Like the multinationals, returning expatriates too have had a mixed effect. They bring scarce talent home, are driven by patriotic fervour, provide valuable global networks, and give their countrymen the confidence and the inspiration to do what they could do themselves. On the negative side, they often set up their own elite and specialised institutions from which only a few benefit. These institutions operate outside the university system, and not only leave the latter impoverished and unreformed but deprive it of a talented faculty. Like the multinationals, the institutions set up by expatriates are geared towards technological innovations and their commercial exploitation, and tend to ignore basic research. In China, for example, many of them were for long confined to the 'import zone' and contributed little to the development of the country's scientific base. They got, and in some cases still remain, sucked into the persuasive spirit of 'techno-nationalism', for which science is little more than a symbol of national power and status rather than an inherently open form of inquiry capable of contributing to a rational and reflective wider culture.

It is in this context that we should examine the role of Western universities, scientific institutions, and national and European academies. In my view they can do much to foster a global culture of science, of which the following seem to me to be the most important.

First, they should remain true to the universalist ideals of science, see it as a collective human endeavour, and approach it in the spirit of human solidarity. Governments and businesses tend to foster a nationalist climate in which other countries are seen as rivals and their scientific advances as threats to Western hegemony. One only has to look at the intense fears and anxieties Western governments and multinationals have aroused in response to the so-called 'threats' posed by the rise of China and India, and used these fears and anxieties to discipline their countrymen, silence dissent, and orient scientific research in a particular direction. Western scientists need to rise above and expose the dangers of such a politicisation of science. Science is not a zero-sum game, and the problems we face require cooperative efforts of talented men and women the world over. Science is guided by the pursuit of truth and human well-being, and loses its integrity when subordinated to narrow nationalist considerations. As argued earlier, scientists form a global fraternity and have mutual moral and prudential obligations that stretch beyond national frontiers.

Second, Western scientific institutions should develop and train talents in other parts of the world by means of doctoral scholarships, post-doctoral fellowships, joint researches, helping set up and guide research centres, and so on. They no doubt do this at present, but they need to expand it and pursue it with a greater sense of urgency. Global justice in our interdependent but highly unequal world requires concerted efforts directed not only at the economic but also at the intellectual and scientific development. Here it would be helpful to combine the bottom-up British model, in which individual scientists and institutions across the world establish forms of collaboration, with the top-down French model in which selected institutions set up joint centrally coordinated centres of research. A good example of the latter is the Indo-French Centre for the Promotion of Advanced Research set up in 1987.[8] It began by inviting research proposals and selected around 250 of them. It has, during the past two decades, promoted 1700 exchange visits, trained more than one hundred PhDs, offered a hundred post-doctoral positions to young Indian researchers in French institutions, organised several bilateral workshops and seminars, and led to nearly 1200 joint publications in respected journals. The two governments announced the setting up of ten new laboratories in 2004, aimed at joint work in selected areas such as water science technology, organic chemistry, solid state chemistry, mathematics, IT, and bioinformatics. The French model is heavily focused, centred on established institutions, and elitist in its orientation. It has its obvious drawbacks which the more diffused British approach can rectify.

Third, if the developing countries are to create world-class universities and foster high quality scientific and technological research, they desperately need world class scientists from abroad. Most of them are in no position either to pay the salaries these scientists rightly demand and earn at home, or to provide the kind of research facilities they need. One way to deal with this is to set up a global scientific fund, but this is unlikely, especially in the current economic climate. A better way is to find ways of attracting retired Western scientists to the developing countries in sufficient numbers to act as a strong catalyst. They have done their life's work, have more free time, do not have young families and outstanding mortgages, and no longer need expensive research laboratories to make their mark. They have their well-earned pensions and do not need full salaries either. Many of them are also likely to have built up contacts in the developing countries through the students they have taught and the colleagues they have interacted with over the years. They might welcome the opportunity to spend part of their old age in hopefully more congenial climates, to see themselves and show their grandchildren a bit of the world, and to enjoy the satisfaction of serving both their discipline and their fellow men. There is a large pool of retired or semi-retired distinguished scientists who could be a source of enormous global benefit if sensitively and suitably utilised. Many Western doctors are known to volunteer to work in medical camps and teach in hospitals in developing countries. There is no reason why such practices should not be extended to universities and scientific institutions.

Finally, in science as in other areas of life, quality control and reassurance is essential. It is vital to identify talented minds, set them high standards, stimulate their ambition, and assure them appropriate recognition and esteem. In Britain, being elected a Fellow of the Royal Society is a widely sought after status, just as being elected a Fellow of the British Academy is in the social sciences and the humanities. A Fellow of the Royal Society knows, as do others, that he has done something worthwhile, that he is a Fellow not by corrupt means or favouritism but because of his genuine achievements. The Royal Society represents the collective voice of British science, keeps a watchful eye on the British scientific community, grants recognition to talents, and acts as a custodian of the highest intellectual and ethical standards. Its counterparts in other Western countries perform broadly similar functions.

Unfortunately such academies do not exist in most developing countries. Their scientists have no prizes to win, no recognition to secure, no guarantee that when they do get recognised this is based wholly on their achievements. Science there has no collective voice and no protection against political manipulations, commercial exploitation, and the temptation to secure funds or esteem by faking results. It would be a good idea to help set up such academies in these countries, to work closely with them, and even perhaps to aim at a federally constituted

Global Academy of Science. I proposed setting up the Indian equivalent of the British Academy to several friends in India, and their response was quite enthusiastic. The Academia Europaea and the European Research Council could perhaps take a similar global initiative in the natural sciences.

To conclude, I have suggested above some ways of promoting a global climate of scientific and technological research, and making science a self-limiting but most valuable component of the emerging global moral culture. Thanks to their currently privileged position, Western scientists carry a heavy historical responsibility. If they fail to display the spirit of human solidarity that our interdependent world requires, and stretch out their helping hand to those who desperately need it, they will let down not only themselves and the great discipline they serve but also millions of their fellow humans who rightly look up to them to give our deeply troubled and fractious world a new lead.

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Notes and References

1. China's share of the world's scientific publications shot up from 2.5 to 6.52%, and South Korea's from 0.70 to 2.70%, between 1995 and 2004. During the same period, the share of France and the UK declined by 0.5% and that of the US by 3%. See C. Headbeater and J. Wilsdon (2007) *The Atlas of Ideas: How Asian Innovation can Benefit us all* (London: Demos), p. 6.
2. Dr Han Hoon, a Korean immunologist experimenting with stem cells in liver treatments, thinks, perhaps too optimistically, that by blending eastern philosophies of prevention with the latest advances in genetics, Asian science might provide an alternative to and even leap ahead of western approaches. See C. Headbeater and J. Wilsdon (2007) *The Atlas of Ideas: How Asian Innovation can Benefit us all* (London: Demos), p. 27.
3. World University Ranking, *The Times Higher Education Supplement*, 28 October 2005. This is one of several such rankings and broadly corresponds to their findings.
4. 'IITs have contributed more to innovations in other countries than in India. An IIT is a departure lounge for the global knowledge economy'. See K. Bound (2007) *India: The Uneven Innovator* (London: Demos), p. 14.
5. Cited in C. Headbeater and J. Wilsdon (2007) *The Atlas of Ideas: How Asian Innovation can Benefit us all* (London: Demos), p. 21.
6. India is also setting up Indian Institutes of Scientific Education and Research devoted to fostering research and producing hundreds of PhDs a year.

7. As Professor Balaram of the Indian Institute of Science Bangalore points out, multinational R&D centres are 'only geographically located in Bangalore, they contribute little to the science base here. In fact, as the R&D centres grow, interaction with science diminishes'. Cited in K. Bound (2007) *India: The Uneven Innovator* (London: Demos), p. 34.
8. K. Bound (2007) *India: The Uneven Innovator* (London: Demos), p. 48.

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