Genes and the Environment :

The Genetic Basis of Some of our Environmental Problems

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Parisar was founded on 5th June 1981 out of a deep concern for the rapid degradation of urban and rural environment in India, as also the threat posed to the ecological balance on the global level. Convinced that the poor, dispossessed common people are the first and major victims of environmental degradations, Parisar, at the day to day level, has been actively engaged in the fight to save Pune city from further deterioration.

Through lectures, discussion meetings, film shows, exhibitions, publications etc., it has constantly endeavoured to focus attention on larger environmental issues in order to raise the consciousness of the people and generate public opinion in support of environmental protection policies and programmes.

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Between World Environment Day last year and today there is a major qualitative difference. The terrifying events of Bhopal that took place in the first week of December, and in which who knows how many hundreds lost their lives, and how many thousands more have been irreparably maimed, still retain their poignancy. The scale of the disaster is so vast that we have not yet as a nation formulated adequate means to cope with it.

What happened at Bhopal makes us suddenly feel old, tired, experienced: it was the climax of a hazardous system, its clout unprecedented because too many warnings had been allowed to accumulate, carelessly unheeded. In many years to come, generations will compare Bhopal with Hiroshima and Nagasaki, the only difference being that one mass killing took place during peacetime, the other during a war. Both incidents strain belief. Normal men would not like to be associated with them, with their creation and their execution.

Ostensibly there is the matter of intent that distinguishes the Japanese encounter with atomic bombs and the Indian encounter with MIC. The atomic bombing of Japan was a matter of design. So-called reasonable men who would not like us to consider them mad, for they claimed to be in full possession of their faculties, planned and executed the bomb drops. The Japanese population was shocked into disbelief at the overwhelming destructive impact of the bombs, but it was even more appalled that there could exist people, leaders, in the so-called twentieth century, an age of so much knowledge, who could plan and execute evil on such a magnificent scale.

If it had been merely the question of a few insane leaders (Hitler has been painted in psychopathological terms), their decision to use the bombs on innocent civilian populations might have been made plausible. People who unleash atomic bombs are better off in lunatic asylums. But we are speaking here of leaders occupying the highest echelons of the American ruling elite. If the use of nuclear power to devastate civilian populations is reasonable then we have to conclude that the same reason is profoundly associated with a violent and destructive pathology.

The Bhopal MIC disaster is made out to be an accident, bad but unfortunate. On the surface it is. Certainly if the technicians in charge had had any inkling of what large quantities of water could do to large quantities of stored MIC, they would have been more careful at every turn. I doubt however whether even Union Carbide USA knew any better. But considered more intensively, Bhopal was no accident. Like Hiroshima and Nagasaki, it was also part of an overall design, in this case, western civilisation's all out war against insects. Once you decide to eliminate other living organisms (who also have a right to live) by toxic means, the doses do not make much of a difference, for the mentality behind the doses is the same. An accident in such circumstances is merely a big dose. The same impact is possible when the routine rationality of millions of farmers disposes them to perpetrate millions of small, yet deadly, doses on their environments. Just because the impact is not measured is no reason to believe it is not there.

"Hitlerism and Hiroshima", writes Mahesh K Varma, "are not aberrations or anachronisms; nor do they represent the extreme points of a malfunctioning of the Western socio-economic system. They symbolize the deepest urges of modern civilization and represent the extreme points of its functioning. The diabolism as well as the appalling banality of Auschwitz and Hiroshima is implicit in the fundamental formative idea of modern civilization, namely, that the destiny of man is to create anew himself, the world and history. Experimental atomic explosions abolish the line between the real and the experimental; and, in the last analysis, Hiroshima remains a Masterly Experiment."

In the case of Nagasaki, the plutonium bomb dropped on the city had been tested first in the US at Alamogordo. The uranium bomb dropped on Hiroshima, however, had never been tested any where, either in the US or the rest of the world: it was tested for the first time in the history of the human race directly on a living population. That it was done during a war was just an excuse. Those who perpetrated the atrocity knew the war was already over and that the Japanese were planning to surrender. If there had been no war, some other excuse would have been found later to test the bombs on people somewhere, sometime. The propelling force for that would not have been the politician, but the scientist. Today's scientists erroneously believe that they have the untramelled right to know, which is a poor substitute for the freedom to pursue truth. The scientist has always believed his curiosity can be exercised even if in pursuing it, he blows up the world.

Bhopal too was an experiment, in the sense that Western industrial culture is and continues to be by and large experimental. For example, thousands of chemicals are produced and new ones formulated every year, but since the consequences of these on the environment are not proposed to be studied, we can categorize the general approach as experimental.

The original experiments on MIC exposure on humans were too distressing to be pursued further. So it was firmly decided that any large scale, unplanned exposure was just unthinkable. But no real practical ways of preventing the unthinkable were designed: in fact, just considering the possible consequences should have been sufficient consideration for banning the production of MIC in any form. None of the four or five safety features of the Bhopal plant, if they had been functioning, could have neutralized 40 tonnes of escaping MIC either singly or in concert. Thus the only kind of precaution that UC officials took was to close their minds to any thought that a mass exposure to MIC would one day occur.

This attitude is not abnormal. Even today, with four tonnes of TNT credited to the account of every single individual as a result of a mindless piling of nuclear weapons, we take a similar kind of precaution. We imagine these weapons will never be used, simply because of the horror of their possible impact. We even assert confidently that they cannot be used, despite the fact that the kind of safeguards the globe has today against nuclear weapons eventually exploding are as bad, if not worse, than the kind available at the UC plant in Bhopal.

The only class of people in a sense happy with the Bhopal disaster are the scientists. An undreamt of possibility has come to pass for researchers. What could not be done officially can now be done because of an accident. Some of the people who visited Bhopal were scientists interested in the impact of a military use of the gas. This is present day humanity for you. And every research institute worth the name from the NIO down to the Indian Council of Medical Research has discovered an unlimited source of funds for MIC research. And there continue to be further appeals for more research on MIC related disabilities.

Thus there is more research on MIC than there are efforts to provide relief. Very little MIC related research is even related to relief: this is quite clear from the fact that the results of such research are being kept out of the hands of the victims or the activists of the Zahreeli Gas Kand Morcha. Thus the research is for the purposes of the establishment. Therefore we can expect that the researchers will collude with state authorities to mislead the people, if real dangers are discovered to exist.

So we live in a very dangerous world, a situation unprecedented in human history, and should therefore seek alternatives. There are numerous experts who seem to feel there is nothing really wrong living dangerously. They urge us to be pragmatic. They recommend we consume food containing poisons on the ground that as we have so many people to feed, we need toxic methods. It is such a mentality that must go.

I am a critic of tradition and a critic of modernity. I consider myself a post-traditional, post-modern mind. With modernity I associate scientific rationality, and I am a critic of that too, for I have seen the kind of violence it is associated with, which, unlike others, I find unacceptable. There is a war going on between the natural and the scientific. I believe that if the scientific mentality should dominate, we will cease to live meaningfully any more or with dignity. If on the other hand we can restore the dominion of the natural over our lives, we can work realistically for a more wholesome future, and, I would add, have some purpose in continuing normal human activities, like rearing children and educating them.

I had recently visited the Friends Rural Centre at Rasulia, and wrote an article on what I called a "peaceful agriculture". Nayana Kulkarni translated it into Marathi with an apt title, "Ahimsak Sheti". At once a connection had also been made with an older, compassionate non-violent tradition. When one studies Indian agriculture today, and the recommendations of the Planning Commission which seek to increase the use of pesticides in Indian farming by some thousands of tonnes, one is appalled to consider how far we have departed from humane ideas, from organic, ecological directives, and uncritically adopted the kill and overkill approach. I use the word "overkill" with purpose. Normally one does not kill unless there is compelling reason to, and then too one kills only what is self-threatening. In this sense modern agriculture is sheer lunacy, and in a scheme of things where ahimsa prevailed as a value system, would not be allowed. For in its effort to kill enemies, it does so indiscriminately, and kills all, friendly and not-so-friendly.

Of course, the categories friendly and not-friendly are human creations. Insects do not exist as pests in nature; they have their natural place in the scheme of things. It is when men create imbalances that they also create pests. We then proceed to grant these pests evil intentions, and ourselves honourable ones. Chemical warfare is banned between nations, but not between species, and certainly not against non-human species, which we consider below us in intelligence. If we want proof that we are guilty of the crime of speciecism, here is it. We deny that every species has an inalienable right to exist, to its niche.

People talk about using pesticides as the "scientific" way of doing agriculture. If you do not use pesticides or do not know how to use them, you are an illiterate. This is what scientists say of farmers who do not use pesticides, that such farmers refuse to give up their backward methods. As a result, the pesticide mentality is so widely ingrained, it has even contaminated the organic farming movement. We now have the war continued but by so called organic means that are non-toxic.

Neem is being propagated as a good pest-repellant: our good Mr C.M. Ketkar has been trying to circulate this idea for years. Nobody would listen to him, till they found they had to listen to him. Now the International Rice Research Institute is repeating all his experiments, without giving him any credit. The more neem we use, the better off we are; the more we use our ample resources, the better off the pests are. But we must never forget that we have lost the center of things, that we are dealing with symptoms, and not the real disease. Healthy plants will attract no pests. This is sound theory, just as a healthy human body is highly resistant to disease.

Albert Howard was an English agricultural scientist based for many years in India. Today, he is regarded as the father of the organic farming movement, but we in India do not even know him, even though he invented, tried and tested all his agricultural methods, including the Indore method of composting, in this country. In his book, An Agricultural Testament, Howard almost proved the theory of plant health I have stated above. He maintained two plots of plants: one of these was given ample and proper nutrition in the form of composts, while the other was given just the bare minimum. He found that pests only attacked the weaker plants. It came to such a point that he would deliberately release pests into the plots and find his properly nourished plants intact.

Masanobu Fukuoka, author of The One-Straw Revolution (recently printed here in Pune), and a proponent of no-till, natural farming, supported Howard though he came thirty years after him. Fukuoka observes that in one of his earlier efforts to farm without pesticides, his crops were attacked. There seemed to be grave damage at first, but he later discovered that only the weak plants had been destroyed, and that there had been an automatic thinning out: eventually, the remaining plants produced an excellent crop. Dr. G.A. Naik has written wisely on the impact of what he calls "devitalized" plants on the health of consumers.

Partap Aggarwal testifies to similar experiences in Rasulia. When he first came there, he too decided not to use pesticides at all, even if it meant his crop would go waste. So pests did attack his crop, just as they did the crops of his neighbours. The end result of his not using pesticides? He did lose part of his crop, but not as much as he expected. More important: his neighbours who had used pesticides also lost part of their crops, and they also lost the money they had spent to purchase chemicals. Since Aggarwal had not used pesticides, living organisms in his soil increased, making his plants healthier in the following seasons. Now that his plants are healthier, and he has more birds too in his fields, pest attacks are becoming rarer and should in the future disappear or be totally marginalised. This is how it should be.

The re-emergence of an organic perspective on life and the widespread conviction that our planet is a delicate eco-system in its totality, is responsible for a fresh re-evaluation of technologies that respect the integrity of living organisms and their environments. Man is beginning to grasp the salutary fact that activities alien to evolved biological systems are likely to be damaging and that almost every aspect of existing industrial technology (human business with nature), and medical technology (man's treatment of his own organism) is alien in that sense and must therefore invoke a biological backlash. The processes of nature are cyclical and organic: those of industrial man and his theories are open-ended.

Take medicine. Due to the current preoccupation with disease (our environment today is overcrowded with chemist shops and doctors), we tend to think of all systems of medicine as systems of symptoms and disease. But this is not so in reality. Ayurveda, for example, is a system of health, not disease. It is based on the understanding that a healthy human body is highly resistant, just like a healthy plant, to disease and pests.

Both the Indian and the Chinese conceptions of man are organic holistic ones. Man is an eco-system, reflecting the larger system. Charaka could therefore define disease as imbalance or inequilibrium. In such a situation or context, for example, if we are discussing infectious diseases, one would feel that the initial causative change is not that germs appear to attack the body, but that something happens in the person that permits the breakdown of the normal harmonious balance between the body and the micro-organisms within it or without. The truth is that all but a tiny percentage of all bacteria are not simply harmless but absolutely essential to the continuing well-being of life forms.

Most of the many kinds of bacteria that inhabit the mammalian gut for example and enable it to operate properly are a component of the everyday environment and there is a continual movement of bacteria into and out of the larger living creatures. Everything that lives, whether it is an amoeba or a human being, is nothing more than a leaky bag of cytoplasm and nuclei, with a process of continual exchange going on between it and the environment in which it lives.

The methodological basis of acupuncture or ayurveda could be described thus: the body should not attempt to overpower disease with the active aid of drugs alien to the system; instead, organic techniques should be utilized which aim at restoring the body to its original equilibrium state, where disease by definition ceases.

The unifying principle of allopathy, on the other hand, is its philosophy of counteracting the symptoms of illness. Thus, if high blood pressure is a manifestation of disease, anti-hypertensive drugs are administered; if serious inflammation occurs on the surface of the body, anti-inflammatory medications are applied. How such a theory could have conquered the globe would be interesting to discover, for among all the approaches, it is the most primitive.

For example, the staphylococci that seem to cause boils are normal inhabitants of our skins. Most of the time, their relationship to us is symbiotic - mutually beneficial. Occasionally, that balance breaks down and boils appear. The problem is to restore the balance, not to make the staph germs disappear. An allopath, operating on the basis of the germ theory will treat this condition by trying to destroy the germs, this by giving antibiotics. But antibiotics merely kill off the germs that are most inclined to form harmonious relationships with us, leaving behind the more aggeessive, tougher ones that are less inclined to enter into balanced existence with their hosts. Over the past many years hospitals have become factories for turning out new strains of staph that are not only highly resistant to several generations of antibiotics, but also much more ruthless in their attacks on human beings.

The use of antibiotics in medicine is remarkably similar to the use of pesticides in farming. As any cell physiologist can testify the ways in which our own cellular life processes differ from those of insects are much less important than the ways in which they are similar. Consequently, the application of cellular poisons to our food crops must in a very real way hurt ourselves. So the first point against this way of dealing with insects is that it directly rebounds on us.

More important: as vigorous selective agents, insecticides and pesticides in our world are playing a significant role in the evolutionary development of insect species. They neatly weed out the susceptible members of families, concentrating in insect gene pools all over the world the genetic factors conferring resistance to these chemicals. Thus the use of pesticides, by straightforward principles of natural selection, creates new races of insects, resistant to these substances and often more aggressive. Already, industrial man has got into fast-moving races with a number of species in which resistance has escalated to match escalations of toxicity.

It was discovered very early in the use of antibiotics that naturally resistant strains existed among bacteria, and that prolonged use of a single antibiotic in the treatment of a particular condition, say syphilis, resulted in the emergence of infections almost wholly immune to treatment with that antibiotic, whatever the dose used. In such a situation, researchers could still keep ahead by developing new antibiotics, more complex, more expensive (and correspondingly out of the reach of larger masses of people) with different molecular structures.

In the late fifties, however, first in Japan, then in Britain and the US, bacteriological research revealed that patterns of resistance to single antibiotics had extended to resistance factors covering several of the most widely used antibiotics. What was more, the multi-resistance genetic factor (or factors) could be transmitted directly from one bacterium to another, whether or not these were of the same genus. From the early sixties onward, the threat to public health by these transmissible "R" factors has loomed like a shadow behind antibiotic use and is now seen as one of the most important and significant side-effects of antibiotic strategy.

With the emergence of transmissible "R" factors, we thus have a situation in which bacteria essential to life are capable of passing on to pathogenic, or disease-causing, bacteria, high levels of resistance to a whole range of antibiotics at a single contact. The transmission can be very rapid and in the case of diseases such as typhoid - for whose treatment only one useful antibiotic exists - there is every possibility of the disease emerging in a highly resistant form at any time. Even in people who have never been under antibiotic treatment, there exist gut bacteria possessing a whole range of transmissible resistances to antibiotics.

It was also noticed in the sixties that people treated for a specific condition with antibiotics did not develop as complete a natural immunity to re-infection as might have been expected. This was thought to be so because the elimination of the disease-causing bacteria reduced the opportunity for normal immune reactions - the development of antibodies and so on - to take place.

But now another view is gaining ground: the pattern of what are known as "immune-deficiency" diseases appeared to match exactly the increasing use of antibiotics. Indeed, all the evidence suggests that diseases of this kind, which involve the failure of the intricate and powerful natural defence systems that have evolved over many millions of years to protect man and animal from disease, did not appear on the scene till 1952. They only appeared after the widespread introduction of antibiotics. The implication is quite horrendous: in some way (as yet unknown) the use of antibiotics is interfering with and destroying the natural immune response.

Many factors are responsible for the emergence of pests on a major scale, but one of the principal contributions of science, the reduction of genetic diversity, has rendered the problem qualitatively more serious. The genetic base of crops, plants, animals, trees, is all important. If the genetic resource is weak, extraneous inputs like pesticides may help control the problem, but they cannot prevent disaster when it decides to strike. I wish to deal now with these little known genetic factors: how they are responsible for a large number of the environmental problems we face.

One of the obsessions of the modern mind is the notion of increasing production. Everything is excused provided we can prove that what we are doing is helping to produce more. The bogey of more people to feed is used to force us to accept palpably backward means of producing food. Those who use such arguments rarely go out to see whether the larger quantities of food produced go to the people who need them most, or whether it goes to dogs and cats and pigs abroad.

While governments and experts use a "social" argument for producing more food, they use "economic" means for distributing it when it is generated. Those who have money, buy, those who have no money, eat less or nothing at all.

Population growth has been one of the principal stimuli for increased food production: as land grows scarce, poorer quality lands are brought into use, and existing lands are exploited more intensively. The use of land more intensively forces man to think of fresh ways to maintain soil fertility. Civilizations like India and China have maintained soil fertility for forty centuries. Now, with chemical fertilisers they are getting set to erode it. Traditionally, farmers have used fallows or leguminous crops to maintain fertility, and in many areas they continue to do so. Farmers have, independent of these methods, also relied on genetic means for improving their crops. For example, they have crossed closely related strains of cereals, to exploit hybrid vigour. In all these exercises, the farmer has relied almost exclusively on nature's own reserves of fertility and the immunology bestowed on its genes by long evolutionary trial and error method. In so far as the new crosses were from the same environment, and not too violently separated from nature, ecological balance was maintained.

The so-called high yielding varieties of rice or wheat are a different matter: here the crosses are of material from different environments and distantly related strains. For example, the principal plank of the green revolution in rice is the cross between dwarf and non-dwarf varieties. The result is a dwarf plant that can hold more grain. However, this invention of modern science comes with two major genetic weaknesses. The dwarfing gene is acutely susceptible to pest and viral attacks, and the seed cannot manifest its potential without chemical fertiliser. For the first time the human race has produced seed that cannot cope on its own, but needs to be placed within an artificial environment for growth and output.

Thus we see how the displacement of the natural by the scientific takes place: natural fertility is supplanted by synthetic fertilisers, and the pest control assets of natural diversity are replaced by chemical poisons for a larger population of pests created by uniformity. The very success of the green revolution predisposes it to radical and inevitable failure. To be an extensive success, it must replace local varieties, but in doing so, it must eliminate diversity, encourage genetic erosion. Yet, it is the very same genes of the traditional and wild varieties that can provide the germplasm to protect the so called HYVs.

Thus the so-called HYVs require pesticides, as they do chemical fertilisers, as an essential component of their growth. I have compared them elsewhere with patients in intensive care units. This means extra energy costs. It also means continuous reliance on extra-natural means of protection for survival. Science, the discoverer of evolution, now disdains to use the tremendous experience of evolutionary processes. Immunology is bypassed.

So it is not surprising that in medicine too we nowadays also attempt to bypass immunology. Modern medicine insults evolution by substituting natural defence mechanisms with chemicals. A prime resource is wasted. Every substitution of the natural by the scientific involves such unwarranted wastage. But we tend to forget that this is also the only manner in which modern science can function best. The HYV seed needs treatment from the time it is set for germination till much after the harvest. This over-medicalization, the sum and substance of the green revolution, is parallelled by the over-medicalization of health: from the time the foetus is in the mother's womb, it is now deemed in

need of chemicals of all sorts. The pregnant mother is seen in terms of being in need of constant medical attention and chemicals, and from birth till death, the resultant human being will find he is determined to be in need of chemicals and supplements.

The marvel of modern science is but the result of a clever manipulation of nature's genes: the scientist has not invented a drought resistant gene or a gene that is resistant to the brown plant hopper. He has merely found it growing in its environment, and incorporated it to redeem his own failing invention. I am reminded of an old story: a group of students once thought of fooling their professor, and took to him an insect they had put together with parts of different other insects. And they asked him to identify what kind of an insect it was. And he promptly told them it was a "humbug". Stand back and compare even today the comparative costs and benefits of seeds that grew up in their environments, the so called traditional seeds, and the HYVs: compare the costs of maintaining each, of the quantities of straw produced, the quality of straw produced, the nutrition and taste of each, the autonomy of one and the centralization of the other, and then see who are losers or winners. Add to the tabulations the political costs of multinationals now profiting from the efforts of millions of small farmers via pesticides and fertilisers. It has never happened before.

And to what purpose is it all? To raise food contaminated with poisons. Out of a total of 145 cereal samples of paddy, wheat, jowar and bajra, collected from fields in Pune, Ahmednagar and Thane Districts of Maharashtra, Dr. Mrs. S.A. Banerji found that as high as 110 samples were contaminated, giving an incidence of 76%. 31 of the 110 samples contained pesticide residues above the tolerance limits set by FAO/WHO.

When in Indore recently, I went to visit the wheat and cotton research centres. An added attraction was that I would also be able to see the Albert Howard Institute. What had happened to it? Well, the old building is still there, but the soft science to which Howard contributed is no longer patronised in any of these institutes. At the wheat research institute, they still face the problem of wheat rust, but the imported wheats are still not producing as well as some of the local wheats. The same with cotton, where there are now some interesting developments.

We know the situation in cotton is not what anyone would wish for: the pest problem is terrifying for farmers, and nearly 60 per cent of all pesticide use in the country today is related to cotton farming. And this is a consequence of the kind of hybrid seeds available. They have little evolutionary history. So scientists are getting back to once again crossing local strains, and while they found the crossing could be done by hand, bees did it best (this is supposed to be perhaps another major discovery!).

The problem is bees do not survive in any area where pesticides are extensively used. So if you want to get back to using bees, you have to ban pesticides. I was recently at IRRI in the Philippines, and was told of Dr. Swaminathan's new programme of "Prosperity Through Rice". Our learned doctor is selling a new package combining fish culture with the green revolution (the combination is fairly old, but that time it was not advertised as a solution for poverty via glossy brochures). But the research is blocked simply because the use of pesticides precludes fish culture. Once having eliminated them, it cannot now be hospitable to them. Modern technology cannot be ecological: it excludes rather than enhances options.

Thus it is interesting to note that scientists are being compelled because of ecological reasons to get back to natural processes, and it will not be long before they are compelled to disclose that many local seeds outbid the so called HYVs, and do not need fertilisers and pesticides. Dr Richharia, the rice expert, who was responsible for collecting at one time 19000 varieties of rice at Raipur, documented local seed yields of 9500 kgs per hectare. In my own state of Goa, I have found that the Agriculture Department has documented local seeds outperforming HYVs. When I asked these bureaucrats why they continue to call them the Manila seeds, HYVs, they say that only those seeds with the HYV label can be propagated as per government policy.

Thus, even at this moment, if we did an about turn, identified high yielding local seeds either for rice or wheat, and set out to propagate them, we would be better off in terms of output and input than we are today. We would need less fertiliser plants and the pollution they cause, and we would not need Union Carbides. Neither would we require too much money for research. We would preserve critical germplasm in a living state in the fields. What is after all the need for reducing rice varieties from their phenomenal number of 1,20,000 to just thirty or forty?

We were dimly doing precisely this at one stage, till the government decided to hand over our research directions to institutions controlled by private foundations which have a record of furthering the foreign policy interests of their own countries. The Ford Foundation, for example, destabilised a legitimate regime in Indonesia, as ITT did in Chile. Yet, you will be surprised to know this Foundation continues to meddle with our rice research priorities, and in India the liaison office of IRRI is in the Ford Foundation.

We pretend to have some freedom in the way we do things as a nation today, but actually our options are rigorously limited by external forces and external science. Our import bills for fertiliser and oil alone require such large amounts of foreign exchange that this demand has distorted our development priorities totally out of shape, and compelled us to serve the world economy at the expense of our own population.

Now what has been said of rice and wheat and cotton, their hybrid material, and the ecological problems they create by their demands, can equally be said of animals. This is an even bigger disaster story. Simply because we are a large country, impacts do not show in immediate or concentrated ways. But suffering is induced in thousands of places, and just because the real causes are not strictly identified is no excuse to pretend they do not exist.

So just as we have gone to Mexico and Los Banos for our wheat and rice seed, and to America for our cotton, we have gone to Europe and America for our cattle requirements. We have brought in substandard animals and culls from these places, and with them imported a host of diseases. Now we are all set to make the most absurd import of all time: we are seeking to import between 20,000 - 1,00,000 West German cows, because we feel intensely that cows should not be slaughtered. (Narayan Dube recently told me that 80% of the beef exporters association members are Hindus). The carrying capacity of our land has long been overburdened and crossed. Our own animals can't find fodder to eat in critical months of the year. And we now plan to feed so many thousands more, and these are not ordinary cows, but require, in comparison with our own animals, special buffets.

Another instance of how we think a quick short-cut can bypass evolutionary development by manipulation. It is our xenophilia that is the problem: we have turned ourselves into an international junkyard. Some princess feels we are so

poor we need to be gifted 20,000 junk cows which the German do not want. Some official in the Swedish International Development Agency decides to import thousands of tonnes of kubabul seed into the country to regreen our lands. An American official determines that Indian quarantine measures are to be waived aside to bring in hundreds of tonnes of rice seed from Manila for our rice revolution. In return, these very countries do not permit you to take a bottle of pickle into their borders.

The high productivity of the European cows is a result of selective breeding in their own environments. We have this strange notion that productivity can be translocated from environment to environment: this may be true to some degree of mechanical processes, but biological processes are a different proposition altogether, since they do not operate independent of their adapted environments. We also tend to overlook the related point that the high yields of European cows would not be possible without large quantities of feed raised on prime agricultural lands in the third world: the high yield is associated with greater demands on the environment in terms of energy and food demand.

Not that the genetic improvement of our own pure breeds will completely solve the problem: genetic improvement cannot take place in the absence of good fodders. But it is also true that in the absence of good quality fodders, selective breeding is still preferable to cross-breeding: for besides poor food, the animal must also get acclimatised, must attain immunity to disease and be able to withstand drought. Here Indian breeds have a decided advantage.

The maintenance of exotic herds which require special feed has in turn its own consequences: to produce, for example, the milk of Kaira district, a large proportion of the country's cotton-seed cake has to be diverted there. The more we divert scarce cattle feed to concentrated pockets, the less resources we have to feed our local herds, which will degenerate further, affecting agriculture as a whole. In fact, by this means we calculatedly withdraw feed rations from them. So we have in effect an active programme of destabilization, if any: the import of such cows is ecologically reprehensible and totally irresponsible.

What is true of animals is also true of trees. We have thousands upon thousands of indigenous species of trees, part of folklore, religion, culture, but for some reason we have contempt for them. I can understand that we do not expect much from, say, a mechanical or electronic gadget produced in India in comparison with one produced in Japan, for it is not based on the vast research resources and funds the latter economy has been able to command. But where does this affect evolution? Trees are trees, here or there, in India or in the Philippines. They are closely tuned not only to their natural, but to their socio-cultural environments. So why choose exotic species when we have so many of our own, equally good, ecologically better?

In actual fact then, we need no great support or germplasm from without our borders. I have just been reading a village manual published in 1930 by the then Mysore government, and it clearly lists the kinds of trees that should be taken up for planting to meet the fuel, food and fodder -demands of the rural population. But here too the craze for quick fixes has overwhelmed us. International financial agencies like the World Bank and others want their regular returns, which they claim can only be met from ecological menaces like eucalyptus and now subabul. These trees are alleged to grow faster and produce more. The definition of productivity, like that with cows, is cleverly fabricated.

For there is no such thing really as a quick growing tree in nature: there are only trees that exploit scarce resources like water faster, and secrete substances that inhibit the growth of competitors. Elsewhere, I have used the

eucalyptus tree as a prototype of the modern industrial system: both seem dynamic, while other methods of growing, of producing, seem stagnant by comparison. Both are passed off as achievements of using scientific knowledge. But in practice both can operate successfully because they are permitted to guzzle resources at a phenomenal speed, often at the expense of others in the same environment, or without concern for future generations. The results are quick, but temporary, and depletion is a natural, inevitable consequence of both.

In addition, there is this con-game involved. The businessmen and the planners want economic growth, more profits, more industry. If indigenous trees are planted, since these will service local populations, they will not be available for industry. Biomass is better processed for capitalists through industrial processes: paper, pulp, rayon. If it is consumed by villagers, it does not register as economic growth, merely as non-industrial elements like smoke, heat, and dung.

I have come to believe that part of our problem arises with our education and the way we define things. If you look at scientific activity as a whole, you will find that most of it ends up as redefining activity - the scientific understanding seeks to replace what actually works in nature; rather, science constantly seeks to substitute its own interpretations of natural laws, always incomplete and distorted, for the natural laws themselves.

Since the scientific reason is however only a part of nature, and the part cannot structurally or logically comprehend the operation of the whole, we are prevented forever from grasping nature via reason in its totality. For this reason, empirical reason in Indian philosophy is permitted to go so far and no further and cannot contend to absolute truth. Western scientific reason pretends to possibilities barred to it.

Thus at a very fundamental level, we have a major misfit between science and nature. It follows that technologies based on such science must necessarily misfit their environments, producing pollution. When one goes deeper into this question, one finds even greater instances of misfitting. Science may improve, but the technology based on it takes longer to improve. And very often, big business, development, politics conspire to see that technologies as a rule have very little to do with the latest, most improved science.

I have come to the conclusion that what one also needs in the circumstances is a critique of modern science, and development based on such science. This is because of the close connections that are now quite obvious between science and development, and development and the continuing enrichment of erstwhile ruling elites. In this collusion, science provides the ruling establishments of the globe definitions and justifications that legitimate current activity and development, often at the expense of the underprivileged.

To illustrate how science does this, I have a very vivid example. It is in a sense appropriate that my example has to do with forests. A forest is a community of interdependent species, living in close symbiosis. There are no pests, and there is no need of external fertility inputs. The interrelationships are in a sense infinite, and cannot really be duplicated by human means. A natural forest is its own creation. No amount of modern science can help recreate a natural forest. This any ecologist would admit.

But this affront to science has to be met somehow. So science does the next best thing: It redefines the notion of a forest in terms of biomass. So called scientific forestry is little more than extensive monoculture , a prime

exhibit of scientific rationality's pervasive reductionism. Science proceeds to lable its tree-planting, afforestation. But the activity has nothing to do with forests. Thus we have the substitution process clearly at work. First, science determines that natural forests are too slow, and recommends their removal. Thus it encourages deforestation. It then proceeds to substitute a community with a monoculture of "quick-growing" species, and terms the latter a forest. Thus scientific afforestation becomes nothing less than a form of deforestation. The notion of a forest is degraded in its scientific equivalent. This happens practically in every sphere; for example, another major form of substitution is baby food in place of breastmilk. Each substitution is a form of violence.

What I want to draw attention to here is that ecological concerns are realistic concerns only in a society whose major institutions are not under threat for survival or are eroding rapidly. An increasingly violent society cannot be ecologically benign. What is worse, it will eventually destroy even the few experiments in ecological living within it.

Thus besides the programme to plant trees, we need to make efforts to restore society's communitarian ways. I still remember a most vivid quote from a farmer I met in Karnataka, when we discussed the felling of trees. He said: "People are cutting of each other's heads, so what is so distressing about cutting down trees?" We have no argument for that, and it aptly describes much of our present predicament. What is most distressing is that our governments are pledged to promote policies that can only lead to the further degradation of the human environment: I am referring to the singular drive with which governments are encouraging the consumption of liquor, cigarettes, and the celebrated idiot-box.

Let me not conclude by saying we must redesign our education system. What we could do is to take a few schools within our reach and work out methods for restoring a communitarian sense. I am not talking of relations between different religious communities, though that is important. I am talking of building a larger community of people, plants, animals and trees, within the consciousness of the growing child. Compared to many species in the natural world, we are ephemeral creatures. For example, a tree may outgrow and survive three to four generations of people, but somehow we do not think it part of our living consciousness. Likewise with bacteria: compared to the bacterial population, we are the guests and they the hosts, but we foolishly face them as enemies in their own home ground. We have to redesign our cities according to these natural demands, not according to western models, as we have sought to do in the past. We need more animals and trees in our cities, not less. We have to work for a substitution of the almost physical-mechanical curriculum of our schools, by a biological understanding, as a source of a rich and fruitful life.

The movement to substitute indigenous gene pools with exotic genes from other countries is not an isolated trend in our nation's history. It is all part of a larger problem of felt civilisational inferiority that we inherited as a result of our colonial trauma. At the time of our independence, having accepted unquestioningly a number of western notions about ourselves, we decided to recast ourselves in the western mould. So under the inspiration of western scientists and social engineers we attempted to transform our society from an Indian to a Western one, and numerous learned papers and books were manufactured to show us what elements of our culture and tradition were contrary to economic progress, and what elements of Western culture were a *sine qua non* for us to advance.

The same developments took place in technology: we tried to replicate and relocate, partly succeeding, some of the older western technologies in our environment. It was from here only a small step to propose that even our natural

living resources, including the germplasm of our living productive material was deficient, and that we should incorporate and transfer their germplasm into our material. Thus began the great experiment to outcross Indian genes. When you introduce 50% exotic germplasm genetic material from exotic animals into Indian stock, you cross out indigenous genes. You breed them out of existence. So we in effect proposed to wipe out all traces of Indian civilisation as we knew it.

Fortunately, we have come to recognize our collective insanity, and now value our cultures and traditions a little bit more. In fact, in these so called Festivals of India, we flog only Indianness abroad, the same Indianness we have abused for the past forty years. Those outside the Indian culture area, not blinded by any colonial hang-ups, were better in their assessment of the value of India's living, genetic resources. A large amount of precious genetic material, for animals and plants, has been used to strengthen genetic material abroad. We did the reverse: we imported material to weaken our resources. Till today, nobody can really explain why.

The recent Parisar statement on *The Lessons of Bhopal* echoes some of these views and concerns. I am glad to be today among such kindred spirits. I must thank Sujit Patwardhan for reprinting Masanobu Fukuoka's *One Straw Revolution*, and doing it well. I remember others in this city: C.M. Ketkar, of course, and Dr G.A. Naik. That quote of Mahesh Verma I have relied on comes from a little booklet, *Gandhi and the Contemporary World*, published by the Centre for Communication Studies.

In conclusion I would like to propose that in times of such stress, sorrow, violence and disintegration, not just of natural but social environments, we need a new healing force. The issue of indigenous genetic resources is a good starting point. It is at once a political as well as a constructive plank. Without our genes, we are no longer ourselves. So we must work to restore them in the forms so well known to us and our traditions - plants, trees, animals. By so doing, we will also mitigate some severe environmental stresses associated with our past infatuation of the exogene.

A group of us have recently formed an association, called the APIGR, the Association for the Propagation of Indian Genetic Resources. It is being headquartered at the Ashram Pratisthan, at Sewagram, Wardha, a place closely associated with Gandhi. Part of the reason I accepted this invitation to speak to you was to drum support for some of our activities, programmes and objectives. We have held three meetings, which people attended on their own. One was on organic farming, the second, on indigenous rice varieties, and the third, on indigenous varieties of cattle. We are having a fourth meeting on indigenous trees in August in Pondicherry. If I have kindled some interest in you in these efforts of reconstruction of our polity, I will have considered my visit here more than adequately recompensed.

Thank you.

Masanobu Fukuoka

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