In this issue

Terminal truth about terminator gene?

9 November 1998; 2.30 pm.
The venue: Chambers of the Minister of Agriculture, Karnataka State Government.
The issue: Terminator seed technology and (versus) Transgenic plants.
The context: An article in the daily, *Indian Express*, a few days back had stirred a hornet's nest over the issue and there were claims and counter claims in TV, radio and news magazines about the merits and otherwise of the Bollguard cotton, terminator seeds and the allegiance of Monsanto company to terminator gene technology.

Sitting at one edge of the semicircular conference table laid in front of the minister, I was wondering about the purpose and wisdom of my presence in these corridors where policy decisions are made often on the basis of public demands and other immediate pressures than on the scientific grounds. At the end of a long sitting, we were all indeed greatly impressed by the ease with which the minister consumed all the details some of which we thought might be too technical for him, and by his own understanding of some of the deeper social implications of the terminator gene and the transgenic plants. We came out with the impression that if there is ignorance in these corridors about such issues we may have to blame our own arrogance in thinking that the powers here are dumb to us. They are not!

10 November 1998; 12.30 pm.
The same venue; the same issue; it was a press conference by the minister.
Now sitting in the outermost ring of the audience, I was again, like my other colleagues, highly impressed by the perfection of the details the minister delivered to the press.

But 11 November morning, newspapers belied our expectations. They seemed unwilling to deviate from their general tendency to sensationalize the news. Almost all daily papers had picked up only those details which by a slight twist or turn could make the readers suspect the intentions and the maturity of the state and the system in dealing with the issue. Thus the questions that were so intensely discussed at the minister's chambers still remained unresolved:
Do we need to allow transgenic plants to India? Do we need to allow terminator seed technology to India? Is Monsanto holding the patent for the terminator gene? If it does, can we prevent it getting it into India? Should Monsanto be particularly prevented from introducing the transgenic plants to India because of its allegedly 'not-so-honest' track record in offering environment-friendly technology?

Should one link the benefits our farmers might derive from Monsanto's transgenic plants with the bad experience of the 'Agent Orange' that this company supplied to US army in the Vietnam war? Should we take the failure of 'Bollguard' cotton in some places in USA as a warning signal for a possible repeat of the suicide cases of cotton farmers in India if we introduce it?

In this era of information explosion there is a great need to develop a system to screen the right news from the wrong. This screening task seems to be much more important than that of netting the information *per se*; info shops are growing probably faster than coffee shops and now are in almost every corner. But we need service centres to filter the right from the wrong information and sense from the nonsense.

In the absence of such service centres one way, and not an efficient way of course, is flooding with the right information such that it gets noticed simply by the process of inundation. In this background another article on terminator gene (after a couple of earlier articles) and its social and political implications by Gupta finds its rightful place in this issue of *Current Science* (**page 1319**). This article besides offering the details of the technology also suggests possible ways to guard ourselves against the impending problems of the terminator technology.

K. N. Ganeshaiah

Vortex breakdown in turbomachinery

A significant fraction of our generated power comes in the form of hydroelectricity where the potential energy of stored water is used to drive a hydraulic turbine connected to an electric generator. The turbine itself consists of a number of specially-shaped blades attached to a hub on a rotating shaft; in a well-designed turbine, the flowing water turns the runner efficiently with as little loss as possible so that its energy is converted to useful electrical energy. In this process it is inevitable that a certain amount of angular momentum will be imparted to the flowing water and under certain circumstances a strong vortex will be formed in the draft tube or ducting downstream of the turbine. The existence of this vortex, which is essentially a swirling flow field, can have serious consequences for the performance of the turbine.

It is a well known fact that water turbines perform poorly when operated at off-design conditions. Under these circumstances the flow becomes unsteady with powerful periodic oscillations in the pressure and power and with consequent increase in vibrations and noise in the machinery; needless to say the efficiency falls. It is believed that this condition is due to the eccentric rotation of the vortex core formed by the high swirl of the flow coming out of the turbine into the draft tube. A related phenomenon is that of *pressure surge* in turbines operating at small part load; these pressure oscillations can be so severe that the turbine has to be shut down. It appears that surge is caused by *vortex breakdown*, where the swirling flow suddenly switches to a topologically different mode with attendant unsteadiness and losses. All this points out the need to understand and control vortex phenomena in turbomachinery.

In this issue Sharma *et al.* (page 1355) present a study relevant to the flow fields mentioned above. They use hot wire anemometry to examine the swirling flow in a draft tube generated by a runner or turbine driven by air in a blow down wind tunnel. When the signals from the hot wire are analysed using an FFT spectrum analyser they find that, outside a narrow range around the design point, oscillations similar to those found in vortex breakdown do indeed occur. They conclude that these oscillations are identical to those found in water turbine surge. Moreover, because these experiments done in the laboratory are controlled, the dependence of vortex breakdown in the draft tube on a well-defined angular momentum parameter can be quantified. Scientific studies such as these can play an important role in incrementally improving the design and performance of industrial equipment with consequent benefit to the whole economy.

P. N. Shankar

CURRENT SCIENCE

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EDITORIAL

History in science

Is the history of science important enough to be taught or even occasionally discussed by teachers and students? Or is history something that ageing scientists are comfortable with (living in the past can be pleasantly sedative), while the young are clearly more concerned with the future. In our surroundings, wrestling with the problems of the present can sometimes be an overwhelming task, leaving little time for contemplating the past or the future. In many subjects in the sciences, the volume of information that needs to be transmitted to new students has increased enormously in the past fifty years. Teachers struggle to be coherent, comprehensive and correct even in post-graduate courses. Their task is not lightened by rigid syllabi, archaic examination systems and the diminishing quality of students entering science courses. Students now enroll for research degrees more poorly prepared than ever before, only to realize that they have entered areas of research, which are moving forward at a breathtaking pace worldwide. In areas like biology and medicine the progress is over such a broad front that new entrants to the field find that the battle to stay abreast is lost even before it has begun. There is so much that is new that has to be assimilated in time spans that become shorter with each passing day. Looking back to logically trace the development of an area, thus appears to be a poor investment of time and effort. History, therefore does not seem to have an important place in the teaching of science today. Few teachers seem to echo Goethe's' famous statement that 'the history of a science is the science itself'.

Scientific papers are invariably written in a sanitized style, in which failures and misinterpretations of data that are common in the course of research are not recorded. The false starts and false trails, that are explored before an even relatively minor research problem is satisfactorily addressed, are never described. Journals have a limited space, editors and referees have a charter to ensure economy of presentation and, of course, most readers are impatient. All of these factors ensure that most scientific papers are incomprehensible to the non-specialist (specialization today is rapidly becoming a case of 'knowing more and more about less and less'). Most papers are certainly unhelpful to students of the subject seeking to explore the origin and development of concepts and techniques. In their haste to provide encyclopaedic coverage of their fields, authors of books too treat historical development in cavalier fashion. Students thus, have only a very hazy view of the history of the fields in which they intend to do research. Balanced views of emerging areas of science are provided by reviews, which have today acquired enormous influence and importance, as witnessed by the phenomenal growth of review journals, focusing on current 'hot' topics. Unfortunately, most often, the average review provides only a round-up of the current literature with almost no reference to historical background of an area.

In reflecting on the relevance of an historical approach to teaching science we might do well to recall Maxwell's appeal to Ampere: 'If you have built up a perfect demonstration do not remove all traces of the scaffolding by which you have raised it'. Looking back can teach us the importance of being wrong. History can sometimes be difficult to write and historical accounts can be even more difficult to judge. In recent days the debate on the reconstitution of the Indian Council of Historical Research emphasizes that 'rewriting' history can be politically expedient. In science, of course, 'history' has been approached in a more detached and scholarly way, but the manner of chronicling events depends very much on the observer. There can be 'biased' and 'personalized' accounts (often very readable) in which the observers are also participants. James Watson's 'The Double Helix' belongs to this genre. At the other end of the spectrum are the more elaborate and well-documented treatments of a field; Robert Olby's 'Path to the Double Helix' is an example. In tracing the growth of a subject, historians of science tread a dangerous path, reminding us of the dictum that 'time blots out small merit while fattening big glory'. An historical approach to teaching a subject can often be inspira-