ANZAAS 1984

SECTION 42 : LAW

PRESIDENTIAL ADDRESS

BIOTECHNOLOGY, INFORMATICS AND ENERGY : HOW MUST THE LAW RESPOND?

THE MARRIAGE OF NEW TECHNOLOGIES

May 1984

ANZAAS 1984

SECTION 42 : LAW

PRESIDENTIAL ADDRESS

BIOTECHNOLOGY, INFORMATICS AND ENERGY : HOW MUST THE LAW RESPOND?

THE MARRIAGE OF NEW TECHNOLOGIES

The Hon Justice MD Kirby CMG
Chairman of the Australian Law Reform Commission
President, Law Section, ANZAAS 1984

ARE LAWYERS NECESSARY?

When my distinguished predecessor as President of the Law Section of ANZAAS, Professor Douglas Whalan, addressed the 52nd Congress in Sydney in December 1982, he asked an important question. It was whether lawyers were really necessary to the science-law relationship.[1] He outlined the diffidence of lawyers in entering the Australian and New Zealand Association for the Advancement of Science and the reservations of scientists in admitting the craft of law to their ranks. He concluded that lawyers were necessary in the development of science and argued for a concept of 'preventative or anticipatory' law.[2] But he cautioned that lawyers should not have a monopoly in the formal law reform process. Interestingly, a similar point was made in New Zealand last month by Lord Scarman. He urged that lawyers must not arrogate to themselves a position of dominance in the society they serve.[3] Professor Whalan has rightly called attention to the pains taken by law reform bodies at least to engage other disciplines in dialogue and to promote a dialogue beyond the law about the purposes and shape of our legal rules and institutions.[4]

It is now clear, if ever there had been doubts, that one of the most dynamic forces for change in the law today is the impact of science and technology on its rules, procedures and personnel. Many of the implications of scientific change are not being addressed efficiently by the legal order. In part, this is because of the general problem of keeping the law up to date when the principal way of doing so is through cumbersome, sometimes medieval parliamentary machinery, not well adapted to the pressures of change of our time.

In part, it is because of a certain problem of communications between scientists and technologists, on the one hand, and lawyers and lawmakers on the other. We tend (with notable exceptions) to speak a different language and to look at the world through difference spectacles. The first group tend to be those who at school were good at mathematics. The second group tend to be those to triumphed in poetry and had a skill with words. Few are the lawyers who are trained in science. One notable exception is Mr. Justice Murphy of the High Court of Australia and President of the Criminology Section of ANZAAS. He graduated with Honours in Science and maintains his interest in scientific journals. Most lawyers and lawmakers find scientific change mysterious, perplexing and uncomfortable. Little wonder that they tend to put its legal implications into the 'too hard basket'.

Mind you, lawyers and scientists share certain things in common. The law operates on proved, not certain, facts. In this sense, lawyers and scientists are content to work with a notion of relative truth. Claims to absolute verities are left to priests and politicians.

In the time available to me for this Presidential address, there is no opportunity for an elegant discourse on the history of famous legal scientists. Nor can I indulge myself with tales of early legal reactions to scientific heresies. (We burned their authors). Nor is there time for an analysis of interesting forensic cases, such as the trial of Dr. Crippen, gripping though that might be. Instead, I must spend my allotted time telling you something about the Australian Law Reform Commission, detailing some of the cases in which we have proposed law reform to put scientific and technological change to the service of the law. Then, I shall instance quickly the three principal areas of science which I see as promoting special problems for the law : biotechnology, informatics and new energy sciences. I shall conclude with comments on the institutional problems posed for Australian society by the engine of science and technology.

USING SCIENCE AND TECHNOLOGY

Almost every one of the tasks assigned by successive Attorneys-General to the Australian Law Reform Commission has involved, directly or indirectly, the pressure for legal change caused by advances in science and technology. In recognition of this fact, from the very outset we have sought to attract to our deliberations, consultants from various scientific disciplines able to help us in the tasks of law reform. In a number of reports, a great deal of attention has been paid to mobilising scientific advances, to set at rest age-old disputes:

- In the Commission's report on Alcohol, Drugs and Driving prepared for this Territory, proposals were made for the use of the modern Breathalyzer which would print out the result of its analysis. The facility was advised for taking skin, blood and other body samples to recognise the limitation of the Breathalyzer, which is not specific to drugs other than alcohol. These proposals were adopted and are law.
- In our report on Criminal Investigation we sought to graft on to the police procedures, many of them virtually unchanged since Robert Peel laid them down in 1829 London, the new facilities of science and technology. To help lay at rest the disputes about the fair conduct of identity parades, we proposed photography of such parades. To help lay at rest the disputes about confessional evidence to police, we proposed tape recording, wherever practicable, of such confessions. To help maintain the independent judicial superintendence of intrusive police actions, we proposed telephone warrants for police in emergency cases. All of these proposals have been adopted. They are part of the Criminal Investigation Bill which the Attorney-General has indicated he will introduce into Federal Parliament soon. That Bill, embracing the advantages of science and technology for police procedures will represent one of the most important law reform measures ever to be placed before Federal Parliament. I have no doubt that tape and video recording, when police become used to it, will prove one of the most important weapons in the armoury of police in their fight against crime.
- In the current project of the Commission on the law of Evidence, we are examining ways in which the rules of evidence applied in Federal courts can be tested against modern psychological research. Experiments show that uninterrupted testimony is much more reliable as a reproduction of accurate recall than testimony which is punctuated by questions. Experiments show conclusively that such questions can distort the reply. When a test group was shown a basketballer, and half were asked 'how tall is the basketballer' and half asked 'how short is the basketballer', the average difference in responses was as much as ten inches. Yet testimony in our courts is produced by techniques of rapid-fire questioning. Can a legal technique so ancient and fundamental be changed by the mere proof of scientists that the centuries-old ways lawyers have been doing things may contribute to positive distortion of recall?
- Even projects which do not appear to have a clear association with science and technology can be shown to be profoundly influenced by these forces. Thus, for example, the current reference on reform of the law governing Service and Execution of Process throughout Australia is, in part, a reaction to the development of fast aeroplanes that can bring witnesses to different parts of the continent with speed and without undue inconvenience.

In these circumstances, some of the preconditions for the interstate summoning of witnesses and other evidence may need review. The reference on Admiralty Jurisdiction requires the Commission to consider whether that ancient jurisdiction of the courts should be expanded to include new vessels akin to ships : hovercraft and even aircraft of various kinds. The reference on Contempt of court presently under consideration by the Commission is made acutely relevant by the developments in the modern media of communications. A statement by Mr Norman Gallagher about judges of the Federal Court may do little to harm that court's esteem in the public eye or to diminish respect for the administration of justice. Yet when reticulated through radio and television to the homes of millions, it may require some response by the courts. In virtually every project of the Australian Law Reform Commission, past and present, some aspect of the impact of science and technology can be seen.

PROBLEMS OF SCIENCE

Energy Sciences. If one were to identify the three principal areas of science in which great advances are occurring that will have implications for the law, one would mention the energy sciences, informatics and biological developments. The South Australian Law Reform Committee has looked at changes in the law that will be needed with any advance in the use of solar energy in Australia. They have examined such matters as the :

- rights of access to solar radiation
- building and planning implications
- consumer protection for solar energy appliances
- control of solar radiation

None of these matters has yet been committed to the Australian Law Reform Commission. One has only to think of the revolution in society and the law brought about by the motor car to consider the potential for legal change that will attend any major shift from fossil fuels. Dr Bradbrooke presented to the last ANZAAS Congress an important series of papers on the legal implications of solar energy. The implications of wind energy and hydro-electric energy have also been the subject of recent study. The OECD already publishes a regular journal simply titled 'Nuclear Law'. It is difficult to foresee the implications of changing energy sources for our legal system. If we go down the nuclear path some of our traditional civil liberties may have to be modified because of the need for greater security around nuclear establishments.

Informatics. The impact of the microchip is only now being felt in the legal profession. So far it has involved word processors, the beginnings of computer retrieval of legal data and greater office efficiency. However, I have no doubt that in time computerisation of land titles will greatly reduce the role which lawyers play in land conveyancing in Australia. As this presently represents 50% of the fee income of the legal profession of this country, the implications of this change for a widely distributed service profession must be carefully evaluated and, above all, prepared for.

In terms of the substantive law, a number of areas of operation will need reconsideration to adjust to the world of computications : computers married to telecommunications systems. I leave aside such matters as national security, the impact of worldwide computications on national languages and culture. If we just look at the changes in our laws that may be needed for the greater vulnerability of the wired society, for the greater protection of the privacy of individuals in respect of computerised personal information data banks and the need for modification of our courtroom rules for the introduction of computer-generated evidence, we can see that there is a major task for reform ahead. The Australian Law Reform Commission in late 1983 delivered a major report on Privacy protection. The report proposed new Federal laws on data protection and data security; telephonic interceptions; electronic surveillance and control of the growing powers of officials to enter into property and the personal space of individuals.

Yet this project on privacy is only one of the many tasks for law reform posed by the advent of the new information technology. There are other tasks to be addressed :

- the growing vulnerability of the wired society and the need for laws to protect society and its members against the dangers posed by terrorism, accident, mistake, natural and man-made disasters and industrial disruption;
- the need for new laws on computer crime, to take cognisance of the fact that the theft of information may, in the nature of the new technology, involve no asportation of property known to the law. The hardware and the software may not be carried away. Access to the data itself may be sufficient to commit the wrongful act. The law, often framed in terms apt for the time when the medium and the message were inseparable, must be adjusted for a time when they can be divorced;
- intellectual property law needs reform, as may be illustrated in the recent litigation in Australia and elsewhere involving the Apple Computer Company. But what form should that new law take? Should we, as some urge, embrace the principle of 'software liberation' or must we in Australia protect the intellectual property claimed by those who devise new software?

- the risk of computer error may require special contracts and special insurance;
- the law of evidence requires modification, and some modifications have already been introduced, to ensure that computer and computer-generated evidence can be admitted in the courts, despite the general rules against the admission of hearsay testimony.

Bio-ethics. The field of bio-ethics presents the most dramatic and in some ways the most difficult area where science promotes the need for law reform. The Law Reform Commission, by a collection of distinguished legal, scientific, philosophical and theological consultants, produced a report on Human Tissue Transplants. That report has now been adopted in all but one of the jurisdictions of Australia. It deals with such controversial implications of transplantation as:

- the definition of brain death
- the regime for donations or the substitution of a legal system of implied donation
- the question of donations by legal minors, under the age of 16, to siblings of non-regenerative tissues in the case of mortal need
- the use of organs and tissues from coroners' cadavers for the production of serum, in the name of a public interest wider than respect for the bodily integrity of the dead.

The success of the implementation of the Human Tissue Transplant report in several jurisdictions of Australia shows that progress can be made in law reform concerning bio-ethics, if the right techniques of expert and public consultation are carefully followed. The success of that project opens up the possibilities for law reform work in many associated areas of great sensitivity. These are neither hypothetical issues, nor are they likely conveniently to go away. They are specially uncomfortable for politicians in the lawmaking process because of the high emotions that they raise. Yet unless the democratic lawmaking system is to prove incompetent to handle such questions, we shall continue to have serious problems associated with bio-ethical questions posed for us by the onrush of the technologists. I refer to such issues as:

- the growing use of artificial insemination by donor (AID)
- the use of foetal tissue for experiments
- the issue of euthanasia and the right of terminal patients in pain to elect to die or not to have 'extraordinary medical means' applied to their survival
- the predicament of doctors at the birth of a spina bifida child or a child born grossly mentally retarded. The jury trial of Dr Leonard Arthur in England shows that this is far from an academic question.

- the advance of genetic engineering
- the development of children by the processes of in vitro fertilisation which has been pioneered in part by Professor Carl Wood and his team of scientists in Melbourne. Australians have not been in the forefront of working out the legal implications of this development. Should IVF be confined to married couples? Should freezing and retention of the human embryo be permitted? If so, should it be permitted for up to 400 years, as is said to be technically possible? What should happen on the death or divorce of the donor parents? Should surrogate parenthood be permitted and if so, with what rights and duties? What are the implications for the passing of property and for human identity? This is one area where our scientific capacity has, so far, completely outstripped our legal ingenuity. Since Professor Whalan's address which touched upon this topic a number of legal reports have been delivered in Australia including by the Victorian Law Reform Commissioner (Professor Louis Waller) and by a committee in Queensland chaired by Justice Alan Demack.[5]
- the development of artificial intelligence, including by the marriage of computing and biological sciences. We are now told that the next generation of space exploration probes is likely to rely almost exclusively on computerised and automated control systems based on artificial intelligence

MARRIAGE OF NEW TECHNOLOGIES

What is not fully realised, especially amongst lawyers, is that the scientific developments I have mentioned are coming together in a marriage of technologies. Already we have seen, during the last decade, the marriage of computers and telecommunications. The microchip has been linked to the satellite. Software has been linked by telefacsimile. Computers chatter away with computers on the other side of the world. The integration of information technologies in this way has demanded the development of a new nomenclature. One French Minister, in apparent relatiation against Franglais, devised the word 'computications' : computers linked by telecommunications. But it is now increasingly accepted that the word 'informatics' will embrace the marraige of information technologies. Informatics poses new dangers, requiring legal responses. It is one thing for a stand-to computer to collect data in a way more efficient than the old-fashioned filing system. It is quite another to distribute that data widely, so that, say, personal information is available at the fingertips of a thousand interrogators in different parts of the country or on the other side of the world. A recognition of these dangers to individual freedoms, national safety and international cultural values has led to the search for international guidelines that can be adapted in domestic law.

It was one such search, in the Organisation for Economic Co-operation and Development, that absorbed my energies in 1978-80 in the development of the guidelines on privacy and trans border data flows. Notably, that effort was rewarded with success, in the adoption of the guidelines by the Council of the OECD. At this time, five years later, Australia is one of three countries only in the OECD which has not adopted the guidelines. The reason given has been the need to consult the States. It is an unconvincing reason and, constitutionally speaking, a quite unnecessary one. Yet it illustrates the difficulty we have in Australia in adjusting the languid law-making process of a federation to the international necessities of rule-making for a common, instantaneous universal fast-movingtechnology.

If the marriage of computers and telecommunications poses dilemmas in the form of informatics, much more puzzling are the problems now being presented by the marriage of informatics and biotechnology. It is now clear that within the coming decade the information technology industry and the life sciences will join together in a new field, one aspect of which will be molecular electronics. Companies such as the Mitsui Corporation of Japan are already planning for this 'marriage' by acquiring a large stake in both biotechnology and micro-electronics. The objective is to turn living material into bio-computers and to use these bio-computers to engineer further living material.[6] In the future, it has been predicted, bio-computers will be partly engineered directly into living systems just as micro-computers are engineered into mechanical systems today. Such bio-computers will monitor activity, adjust performance, speed up or slow down metabolic activity, transform living material into products and perform numerous other supervisory functions. Scientists are now even writing about the day when computers, made of living material, will automatically reproduce themselves, thereby blurring the remaining distinctions between living and mechanical processes.

This merger of biotechnology and computer and communications technologies has been discussed in a recent book called 'Algeny' by Jeremy Rifkin. Rifkin concludes that in the new era of interacting advanced technologies, the distinction between living processes and mechanical processes will be blurred. He says that mankind in the future will live in a world engineered and populated by the creations of the new technology. Rifkin claims that futurologists have generally failed to perceive the full significance of the interacting technologies. He says that people have tended to see the computer revolution as nothing more than a new method of organising information in the industrial age — a kind of sophisticated filing system. But it is Rifkin's thesis that the industrial age reached it apogee in the early 1970s and that since that time we have entered the post-industrial era. Because non-renewable energy is the organising material of the industrial age, its depletion, early signs of which were shown to us in 1974, marks the end of the economic era built from fossil fuels and maintained by them.

On this view of history, the computer caught the 'tail end' of the industrial era. It stretched out the remaining years of that era by organising in a more efficient way the information used in the industrial society. But the real importance of information is yet to be gleaned. It will come in the interaction between the computer, communications technology and the advances in biotechnology. Whereas the machine transformed non-renewable energy sources into economic utilities, the marriage of the microchip with biological material will transform that material into economic products and processes. Predictions are now being made that by the time of the maturity of today's young people, the bio-computer will be commonplace. By successfully engineering living material into an organic computer that can, reproduce itself, transform other living material into economic utilities and even perhaps reason, humanity will assert an even greater control over life itself. Rifkin asserts that when the machines replaced muscle power, mankind's perceptions changed, reflecting the new method of organisation. Darwin constructed Nature in the image of a logical industrial machine. Now, we are, in the Gospel according to Rifkin, beginning to reconstruct Nature in the image of an electronic computer. To the question 'how does nature operate?', the new answer is that it operates in a manner similar to the electronic computer. It is this cybernetics, transferred from the informatics field to biology, that has helped to accelerate advances in biotechnology. But it has also laid the ground work for the use of the computer to engineer living tissue and in this way to usher in an entirely new era in civilisation.

Machines for making short lengths of DNA have been available since early 1980. They rely on computer controlled pumps to mix nucleotides and the chemical agents which help them to bind together. Different chemical processes for bonding nucleotides have been used to speed up manufacturing. Laborious tasks like purifying these DNA pieces and stitching them together in the long chains needed to make products such as insulin are still not fully automated.[7] However, although the machines for this process only came on to the market in 1980, already about a dozen firms sell DNA-making machines, half of them since the beginning of 1984. They include drugs and instrument manufacturers, particularly in the United States, the United Kingdom and the Federal Republic of Germany. As the Economist proclaims, somewhat inelegantly but vividly, the the 'chip' has married the 'bug'.

The genetic engineering industry is still fairly crude. But it is clear that a new era has begun. The interaction of informatics, biotechnology and energy sciences is not fully understood. The implications of this interaction for society are but dimly gleaned. The point to be made is that the scientific development which we have so far seen as an adjunct to the mechanics of the industrial society must now, increasingly, be seen as profound new developments with serious implications for the role of the human being and for the society in which he or she will live in harmony with new science and technology.

THE INSTITUTIONAL IMPLICATIONS

What are the implications of these developments for the lawyer and the law reformer? Clearly they include the institutional implication of whether our society's law-making and law-administering institutions can cope with the many consequences of such radical and rapid change.

At one level, the issue is whether judges, and for that matter juries, most of them 'technically illiterate'[8] can cope with advanced technology through the legal process. We have recently seen large public debates about this issue in the context of the Chamberlain trial and appeals — with suggestions by a number of distinguished scientists of the need for new procedures and possibly new institutions to assess complex and disputed scientific testimony. Legislation has recently been introduced into the House of Lords in England to require a pretrial notification of scientific testimony. This legislation is said to follow the frustration of the Crown at the scientific evidence adduced in the trial of Dr Leonard Arthur. Some writers urge vigorously the limits of judicial competence.[9] Other observers suggest the creation of a special 'science court' to assist courts, agencies and legislatures to decide complex policy issues in areas requiring detailed scientific expertise. Such a science court, utilising primarily scientists and experts, offers one solution. But it is premised on the belief that scientific questions may be extracted from questions of value in policy. In issues involving scientific uncertainty, a science court would explore the purely scientific elements of the debate. It would produce an opinion expressing a probability statement about the extent of scientific uncertainty.[10]

More fundamentally, however, there remains the issue of how our society's law reforming process will react to the social implications of the new technology — including the marriage of new technologies. In short, can our ancient institutions of Parliament, the Executive Government and the courts cope with the dynamics and complexity of today's science and technology as it affects society?

Clearly there are a number of problems:

- The first is to train lawyers who are alert to, knowledgeable about and sympathetic to the language and techniques of science and technology. This will not be easy. Streaming in education begins, in Australian schools, at an early age. Joint law/science or law/computing or law/biology courses are not common. Yet there have been a number of healthy developments. Monash University has established its Centre for Bioethics in which lawyers, philosophers, theologians and medical scientists come together for regular dialogue.

The University of New South Wales has recently announced the establishment of a Centre for the study of interacting science and the law. The University of Tasmania has taken the forward-looking step of appointing Dr Roger Brown of the NSW Institute of Technology to a Chair of Law, with the expectation that he will there advance his interests in law and information science. It was Dr Brown who inaugurated the Journal of Law and Information Science. As well, societies for computers and the law have been inaugurated in many of the jurisdictions of Australia. Medico-legal societies are beginning to examine the puzzling legal problems presented by biotechnology. Unless a future generation of lawyers can be trained who are alert to the implications of science and technology, interested and able to respond to the developments, the law's voice will be muted and its response inadequate to the challenges that are posed because many of these challenges will simply not be seen.

A second problem is the lack of institutional means of responding to these challenges in an orderly, efficient and prompt way. The Australian Law Reform Commission received references on privacy protection and human tissue transplantation. The Victorian Law Reform Commissioner is Chairman of a committee on abnormal conception. The Deputy Chairman of the New South Wales Law Reform Commission chairs a committee on similar topics in New South Wales. Justice Alan Demack presided in a like committee in Queensland. Justice Howard Zelling chaired the committee on solar energy and the law in South Australia. The tasks of examining the social and legal implications of fast-moving science fall to different bodies at different levels of government. Sometimes we fail to address the problems altogether, or do so in a most tardy fashion. Sometimes we address the problems repeatedly, because we have failed to secure a national examination and proceed, instead, with repetitious examinations in the various States. When the Australian Law Reform Commission delivered its report on human tissue transplants it drew attention to the need for an examination of the law on in vitro fertilisation. It invited a further reference to it on that subject, if it was the wish of the government that the matter should be dealt with. In the event no such reference was given. It was left to States of Australia to develop their own approaches. The result has been a multitude of inquiries. There are, of course, advantages in diversity. Indeed it is one of the great advantages of the Federal system of government. By the same token there are also advantages in approaching in a national way problems which are not distinguishable in any significant way from State to State. Such national scrutiny can produce more ample resources and help to promote a national debate of the issues raised. The difficulty is that many of the science/law questions are not readily identifiable as Federal matters under our 1901 Constitution.

Yet unless we can develop national institutions to provide uniform responses, we run the risk of squandering scarce resources, repeating work already done elsewhere, failing to mobilise community opinion adequately and failing to secure the best possible intellectual and other resources to the task. I believe that the success of the Australian Law Reform Commission's endeavour in its report on human tissue transplants illustrates that even difficult questions affecting the interaction of science and law can be dealt with at a national level. Model laws can be prepared and then offered to State and Territory Governments for adoption throughout the country, with or without modifications. Given the large number of problems that are not being attended to, cost-effectiveness suggests that a new national approach of this kind is sorely needed.

Indeed, instead of proceeding with references to ad hoc inquiries or even to standing law reform commissions, respect for the complexity of the issues being raised, their number and the need for interdisciplinary responses, may suggest that a new institution is needed. This would be not a science course but a science/law commission. Such a body would not be dominated (as law reform agencies inevitably are) by lawyers but would involve a more appropriate mixture of lawyers, scientists and experts with other specialist skills. The Australian Law Reform Commission, in a quest for such an institutional arrangement, always secures the appointment of experts appropriate to the discipline involved in the matter under consideration. Thus in the privacy reference experts on computers were appointed as consultants. In the human tissue transplants reference, experts in transplantation surgery were appointed as consultants. In the project on defamation law reform, experts in communications technology were appointed. But it is one thing to be a consultant and another to be a full member of the decision-making body. It is also important, with the marriage of differing technologies, that experts should be brought together able to perceive, to anticipate as Professor Whalan proposed, and to respond to the needs for legal change presented by fast-moving science and technology. I realise the resistance that exists nowadays to the appointment of still more quangos and advisory bodies. Yet the number, complexity and urgency of many of the science/law questions are such that traditional law reforming agencies, headed by judges and overwhelmingly peopled by lawyers, may not always be the best instruments for perceiving and responding to scientific developments as they affect society and its laws.

Even if the appropriate law reforming agency can be established, the problem remains of moving the proposals along with due speed. Movement through the courts or through advisory commissions, where the issues are novel and complex, tends to be slow.

Yet even when those bodies have made their decision, parliamentary responses may be slower still. The institution of Parliament is not well geared to the urgent necessities of law reform in a time of rapid change. The priorities of government business tend to lie elsewhere. The facilities for private members' legislation are poor in Australia. Difficult and technical problems tend to go to the bottom of the pile. Rare is the Member of Parliament who is willing to champion law reform needed to deal with aspects of technological change. Often those aspects are complex, technical and sometimes even boring. Often they are acutely sensitive, as illustrated in numerous biotechnical issues. Insofar as there is a response, it is often a response which seeks to preserve the status quo and reacts antipathetically to scientific developments. The possible use of foetal tissue is a case in point. So is the possible development of cloning in the human species and the marriage of informatics and biotechnology to which I have referred. These are developments that cause fright in many circles. And the response to fear may be either rapid retreat or heavy-handed, insensitive interference.

. There is a fifth problem. It is the tendency to offer solution to complex and novel issues presented by science and technology to the law, without due regard to articulated guiding principles. It is very easy, when difficult and unprecedented problems are posed, to lapse into a series of ad hoc decisions without the benefit of adequate time or resources for clear conceptual thinking. In the field of in vitro fertilisation, for example, there is a danger that solutions will be offered when represent little more than the idiosyncratic opinions of a group of community representatives. Perhaps we cannot do better. But it is, for example, questionable as to why in vitro fertilisation should:

- be confined to married couples, when stable non-married relationships are being increasingly recognised and respected in our legal system;
- be postponed until other efforts have been tried — when every year of delay may diminish the possibilities of success. The requirement of delay may be nothing more than evidence of basic ambivalence to the technique of in vitro fertilisation. Do it. But do not do it too much.

I do not suggest it is easy to find guiding principles. The debate about the fundamental values of law reform is a large and controversial one. Nowhere is it more so than when novel and ill-understood developments of technology pose urgent problems for the legal system. Should cloning be forbidden? Who should decide whether a grossly deformed and retarded neonate should die? By what principle should evidence secured by illegal telephonic interception be available in the courts? What exceptions should be provided to the right of access by data subjects to computerised personal data? Ad hoc solutions can be offered to these questions, but they are less likely to last and to form a coherent body of law reform than a well-thought-out proposal founded on principle and adequate conceptual thinking.

CONCLUSIONS

The great science communicator Jacob Bronowski said that the world today is fuelled and engined by science. To ignore this, he claimed, was to walk with eyes open to slavery. This is an uncomfortable message for the law. Lawyers tend, as a group, to be uncomfortable with science and technology. Uncomfortably for lawyers, the age of poetry and words has been replaced by the age of interplanetary travel, microchips and DNA.

The first faltering institutional steps have been taken to provide a response to the advance of science and technology as it impacts the legal system. Some answers are offered in the courts. Law reforming agencies and temporary ad hoc committees are offering other answers to broader questions.

But the issue remains whether lawyers will be able, by dint of their training, to perceive the issues that have to be solved in time; whether they will have the multidiciplinary institutions to help provide the response; whether even if they do, the law-making processes of Parliament will be able to respond at adequate speed and to adapt, as advances require adaptation; and whether the laws proposed will be anything more than ad hoc ruminations of an indiosyncratic quality.

It is later than we think. We are in an Indian Summer of the law and our law-making institutions. They were developed in earlier, simpler, more languid times. There must be doubt that they can respond to the challenge of science and technology today. Forthe health of our society and the Rule of Law, it is important that lawyers and other citizens should give careful thought to the institutional question for it far transcends in importance any particular issue of the science/law dialogue.

FOOTNOTES

1. DJ Whalan, 'The Science-Law Relationship : Are Lawyers Really Necessary?' (1982) 56 ALJ 658.

2. ibid.

3. Lord Scarman, New Zealand Law Conference, Rotorua, 1984, Triennial Times, April 1984.

4. Whalan, 660.

5. Queensland, Report of the Special Committee appointed by the Queensland Government to Inquire into the Laws Relating to Artificial Insemination, In Vitro Fertilisation and Other Related Matters, 1984 (two vols).

6. J Rifkin, Algeny, Viking Press, 1983. See Datamation, May 1983. Cf Future Watch No 6 September/October 1983, 5.

7. The Economist, 9 July 1983, 74.

8. Bazelon CJ in Ethyl Corporation v EPA, 541 F 2d 1, 67 (DC CIR). Cf DL Bazelone, 'Coping With Technology Through the Legal Process', 62 Cornell L Rev 817 (1977).

9. S Jasanoff and D Nelkin, 'Science, Technology and the Limits of Judicial Competence' 68 American Bar Association Journal, 1094 (1982). Cf HT Markey, 'Science and Law : A Dialogue on Understanding' 68 American Bar Association Journal, 154 (1982).

10. JN Martin, 'Procedures for Decision-making Under Conditions of Scientific Uncertainty : The Science Court Proposal', 16 Harvard Journal on Legislation, 443 (1979). See also J Ravetz, 'Scientific Knowledge and Expert Advice in Debates About Large Technological Innovations' 16 Minerva 273, 277 (1978); K Prewitt, 'Scienticit Illiteracy and Democratic Theory, 112 Daedalus 49 (1983).