Sharing Knowledge

A Guide to Effective Science Communication

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Chapter 1

A case for sharing knowledge

Knowledge is expanding more rapidly today than at any period in history – by one estimate it is doubling every seven years. Yet the rate of human development – especially our capacity to overcome poverty, achieve a sustainable world and improve the health and welfare of all (or even most) people – remains shackled. One of the greatest limitations is our inability to share and disseminate new knowledge swiftly and effectively in forms that people can use.

There are many excellent reasons for sharing knowledge more widely and more equitably among people, or effectively within economies – to improve health, economic growth, trade, employment, sustainability – but in the present age one of the most pressing lies in a paradox: the more knowledge we find, the less easily and readily do we seem to share it.

The 16th century philosopher Francis Bacon said of science: *nam et ipse scientia potestas est* (knowledge is power). However, over the next 250 years or more this did not preclude those without power from acquiring knowledge and empowering themselves. The rise of general and university education greatly accelerated this trend, but even those without an education could obtain better knowledge and technology with comparative freedom.

The 20th century brought with it the greatest flowering of knowledge in the million-year story of humanity. Yet, differing in degree from previous periods of intellectual and technological growth – such as Egypt, classical Greece, China, the rise of mediaeval Islamic scholarship and the Renaissance – the primary driving force of 20th century innovation was war. The automobile, the aircraft, the computer, electronics and communication, rocketry, modern chemistry and even aspects of medicine and biology all attained widespread application as components of the military engine and helped define the structure of the modern scientific enterprise. The 20th century thus brought an important change to the character of human discovery and innovation: innocent quests such as the desire to understand the universe or how diseases and chemicals behave were significantly industrialised and recruited to destructive and exclusive aims.

Knowledge, previously regarded by faiths such as Hinduism as the common heritage of humanity, became the close-held asset of the few – a handful of nations, a few corporations and, a few societal elites. Even half a century ago some in science were profoundly disturbed by this trend. Sir Henry Dale, president of the British Royal Society, said in 1946:

> *I hold it to be our right and our duty to unite in telling the world insistently that if national policies fail to free science in peace from the secrecy it accepted as a necessity of war, they will poison its very spirit…*[1]

The founder of Australia's CSIRO, Sir David Rivett, too, spoke of:

> *...the threat, now much more than a mere threat, to that free trade in scientific knowledge of all kinds, which has been the glory of these last three hundred years that have seen the most rapid advance in human knowledge of Nature since man began his course.*[2]

Rivett encapsulated the issue thus: 'If one wants two words to suggest the whole problem and keep it in one's mind, I think one might choose Science and Con-science'. Five decades on it is time to ask: what has changed?

At the end of a century that yielded more wealth, more discoveries and more technologies than the previous 70 centuries of civilisation, there were more poor, more disempowered, more wretched and excluded, more hungry and diseased than ever. While it extended lifetimes and brought wealth and privilege for one in ten people, the greatest burgeoning of human knowledge had failed, on the whole, to deliver anything approximating a fair sharing of the benefits. A possible explanation is that the system that engendered it was shaped, not for sharing, but for exclusion and domination.

As humanity progresses through the 21st century – the global century – many scholars have pointed to the emergence of a grave trend: the world is dividing into those with ready access to knowledge and its fruits, and those without. The people without access to knowledge are not merely subordinated, they may actually be outcast, playing the role of spectators in the human race rather than runners in it. Canadian Trade Minister Pierre Pettigrew put it this way:

> *In the new economy, the victims are not only exploited, they're excluded. You may be in a situation where you are not needed to create wealth. This phenomenon of exclusion is far more radical than the phenomenon of exploitation.*[3]

By an irony, the situation of these people is exacerbated by certain ubiquitous technologies. The universal penetration of the media – satellite TV, the World Wide Web, movies, advertising, magazines – is sharpening the distinctions between those with access to knowledge and those without access in an insidious fashion. Formerly, while deep divisions existed, the poor could mostly only guess at the lifestyles of the affluent, especially in other societies. Now the all-pervading visual media flaunts those lifestyles and their conspicuous consumption before them, on every street and in many homes. An unintended byproduct of globalisation is the envy, resentment and wrath it is kindling.

This situation presents risks for global as well as societal stability. There is persuasive evidence that two out of every three major conflicts of the hundred and more that took place in the decade following the end of the Cold War had their deep roots in lack of access to basic resources, food, land and water, and not in the political, religious and ethnic issues that presented the superficial pretexts for conflict. The inadequacy of food, water and other factors essential to existence is due not merely to enlarged populations and strained natural resources but also to a lack of knowledge about how to use those resources sustainably, equitably and productively. These embers are fanned by the conspicuous contrast between those with access to knowledge and those without.

The character of 21st century conflict is emerging as quite different from that of 20th century strife, being increasingly characterised by this deficiency in basic human needs, resources and knowledge. Many countries, several regions and some continents exist in a state of precarious instability as vast pressures build up beneath the surface of societies.[4]

Indeed, some argue that the Third World War has already begun between the haves and have-nots, the knowledge-empowered and the knowledge-deprived. It is being fought out not on battlefields but in the streets and alleys, the festering shanty towns and struggling villages, the spreading global cancer of drugs taken to blot out the misery of deprivation, the *ennui* of exclusion. In the developing world it overthrows governments, causes infant democracies to founder, and unleashes tidal floods of refugees internally and across international borders. It is a driving force in the circumstances that led to the Global War on Terror. In the developed world it is turning sections of great cities into combat zones where the affluent inhabit electronic fortresses and the poor and knowledge-deprived stalk streets where police fear to tread.[5]

While one in four humans lives in abject poverty on less than a dollar a day, it is thought that two out of every three humans – and possibly more – live in a state of knowledge deprivation, meaning they cannot obtain the knowledge or technology necessary to live a decent life, raise their children, enjoy good health and improve their circumstances. Many cannot even make a phone call. In the era of the internet, none of them are 'wired'. They lack the resources to further their own prosperity, health and sustainability, but also the self-respect and self-empowerment that go with supporting themselves and solving their own problems.

Like native cultures overwhelmed by technologically-dominant colonial societies of the past, the knowledge-deprived of the 21st century are finding themselves at the margins of humanity, a place where even survival is doubtful for many. Every 15 minutes about 400 children, the equivalent of a jumbo-jet load, die from malnutrition-related disease.[6] They are also dying from a lack of knowledge. The knowledge to save almost all of them exists, but for various reasons it does not get through, at least in forms their community can access, afford or use.

In 2002, 25 million people were dying in Africa alone without anti-AIDS drugs – not because the drugs did not exist, but because their owners declined to distribute them off-patent.[7] Every year, about two million people die for want of low-cost anti-malarials. Permitting so many to perish in this fashion has prompted many to question the morality of the global innovation system.

The knowledge-deprived live in both the developed and developing worlds. They live among us, every day, in each society, almost in every street, suburb or rural hamlet. They include our blood relatives as well as people we have never met. Their only offence is to live 'outside' the great axes of high tech advancement, learning and commerce that are radiating like a giant neural network across the globe. A 21st century world of infotechnology, biotechnology, nanotechnology, genetic transformation, proteomics, bioinformatics and the other high, enabling sciences appears to them to be saying: 'We no longer need you. Your views, values and skills are irrelevant. Your own knowledge is outmoded. Go away, and don't get in the path of progress'.

Science for most of its history has subscribed strongly to the ideal of serving humanity, and is perplexed at the criticism it now encounters more and more frequently. Professor Juan Roederer writes:

> *One would think that scientists have a lot of friends and enjoy public respect. After all, statistics clearly demonstrate that over 50 per cent of the economic growth in advanced countries is based on the application of government-sponsored research.*
>
> *So why is it that in many countries – and most notably the advanced countries – we scientists have no defined constituency, being viewed by*

> *politicians as naïve, socially ineffective and self important. Why is it that pseudo-science, anti-intellectualism, irrational beliefs and cults flourish like never before? Why is it that universities… are coming under malicious, sometimes even vicious public scrutiny?*[8]

Roederer concludes there is 'an alarming erosion of public trust' in science, which is causing many societies and their political leaders to suspect the motives of the research community, and to begin to set in place measures designed to scrutinise it and even to limit its scope and freedoms. It goes without saying that such limitations, when placed upon science, usually have harmful consequences for free thought, the exploration of ideas and the ability of science to make new discoveries.

The 'crisis of trust' in modern science was highlighted in the UK House of Lords Third Report on Science and Technology, which recorded 'much interest but little trust' among the British public in science today:

> *Society's relationship with science is in a critical phase. Science today is exciting and full of opportunities. Yet public confidence in scientific advice to Government has been rocked by BSE; and many people are uneasy about the rapid advance of areas such as biotechnology and IT – even though, for everyday purposes, they take science and technology for granted. This crisis of confidence is of great importance both to… society and … science.*[9]

Not surprisingly, many societies and groups are starting to protest their exclusion from the scientific process. While grateful for the life-saving and life-enhancing benefits of science, in western democracies the community is already jerking the reins, resisting the relentless onward thrust of knowledge acquisition and application. Some are retreating into age-old beliefs, new-age beliefs, superstitions, pseudosciences, alternative medicines and conspiracy theories, and there is a general questioning in almost all societies of the morality, ethics, practices, motives, ownership and control of modern science.

Many reasons are put forward for this: the impact of global media and international corporations, the rising mistrust of governments, professions, institutions and power elites, and the rapid transit of ideas and emotions around the globe. Nevertheless, by an irony of history, the mediaeval world has somehow been reborn, with the creators and possessors of knowledge and power sequestered behind their high monastic walls, and the ruck of humanity outside, excluded yet subject to their determinations.

Another possible explanation for this is mentioned above: the processes of modern science owe less to 18th and 19th century traditions of discovery and sharing of knowledge than to the infrastructure of 20th century warfare, in which the scientific 'arms race' was a dominant feature. In an age when even peaceful businessfolk studiously glean lessons from Sun Tzu in how to defeat one's foes, it is no surprise that stealth, secrecy, headhunting, espionage, exclusivity, rapid deployment, ruthlessness and exploitation have become cardinal attributes of modern science, technology and innovation. Or that ordinary people, required to pay for this science or consume its products, are becoming unnerved and suspicious.

In the decade following the end of the Cold War, however, there was a fresh development, so gradual it has escaped the notice of many in the scientific community. It was the shift from public acceptance of the authority of science towards a questioning of its ethics and trustworthiness. During the Cold War, science stood for national security: it was unpopular, unpatriotic and even personally risky to question it. Science and its secrecy went broadly unchallenged, with the exception of a few isolated voices crying for its rededication to humanity rather than to superpower supremacism. With the ending of the Cold War, however, science became less closely identified with national security and increasingly aligned with the interests of the giant global corporations that were the world's new technology powerhouses and research funding sources. This led to questions being raised in many local communities about whether science was still acting in their interests or those of global wealth and power. People willing to tolerate exclusion for national security reasons were not prepared to put up with it for the sake of foreign commercial interests. Coupled with sensational biological experiments culminating in the cloning of human cells, this led unerringly to a focus on the morality and control of science in the developed world.

This was characterised in the results of a Eurobarometer poll taken in December 2001. The survey, based on a sample of 16,000 residents across the European Union, found a generally positive perception of science and technology (although some regarded it as a sort of Pandora's Box, emitting many ills as well as benefits). However, more than 80 per cent of respondents felt that scientists should be compelled by the authorities to respect moral standards. The implication is plain: if science fails to manage its own ethical oversight adequately and transparently, then society will seek to enforce it.[10]

In the developing world there is a parallel situation. Here science has not always been widely regarded as being in the interests of the people because it is, for the most part, the science of foreign countries and cultures. Nevertheless, some forms of science involving agriculture, water, public health, transport and the like have been applied for public good and have brought measurable improvements to people's lives. However, the advent of globalisation has been accompanied by similar doubts and concerns in both the developing and the developed world: is it truly in the interest of the local community, or simply a form of neo-colonialism and cultural subjugation? Local science, starved of funding, faced the dilemma of choosing between sparsely supported public good work and more richly funded activities for foreign corporations, although these seldom guaranteed a benefit to the local community.

Balancing human development

In the morning of the 21st century, knowledge is growing faster than anything that humans now produce, with the possible exception of environmental degradation. Faster than food or minerals, faster than manufactured goods, faster than entertainment, faster even than money. Since the work of economist Paul Rohmer in the 1970s, knowledge has come to be recognised as the primary driver in the creation of wealth.

With such a surfeit of knowledge and with such an abyss widening between the possessors and the dispossessed, perhaps it is time to contemplate a return to a more ancient ideal: that *knowledge is the common heritage of all peoples*. Not a weapon. Not an exclusive possession. A thing to be shared.[11]

For decades the argument has raged between the developed and the developing countries over wealth, debt and exploitation. While there has been some measure of reparation in the form of aid, in nobody's eyes does the return come anywhere close to matching the original transfer of wealth and power. In the eyes of most realists, it never will. It is hard to imagine any developed country freely sharing 80 or 90 per cent of its wealth with the needy peoples of developing countries.

Yet, if the developed world will not share its wealth, it can at least share its knowledge. The cost of sharing this is far lower, in crude financial terms, and is advantageous to both partners because of the growth it brings in trade, employment, peace and stability. It has the salient virtue of permitting developing countries to choose those aspects of science and technology they most need and that best suit their culture, their people and their environment. If the knowledge is widely available within a developing country, it allows individuals and communities to take charge of their own destiny and to build a better future for themselves and their children. This in turn brings prosperity, and prosperity can deliver three critical benefits:

- a voluntary reduction in the birth rate, leading ultimately to reduced pressure on natural resources;
- greater political stability and democratisation, fewer conflicts and refugee crises; and
- enhanced trade and employment, to the mutual benefit of both developed and developing partners.

The difference between knowledge and money is that money is easily squandered and, then, cannot readily be renewed. Knowledge, it is true, may be wasted – but once shared, it is usually remains accessible to a community for a very long time and can be applied when required. The knowledge of how to make stone tools has been around for at least two million years and is still applied in some cultures. One of the profound triumphs of the 20th century was the sharing of agricultural knowledge between the developed and developing worlds, yielding miracles such as the Green Revolution and providing the launching pad of economies such as China and India. It is easy to see how the gift of knowledge, once adapted sensitively for local culture and conditions, can be used by billions of people to better their lot. It is also clear that knowledge in the hands of billions of people can do more good and generate more economic growth than it can by merely occupying university library shelves or being restricted to a limited market in affluent nations.

Since knowledge does lead to wealth and power, as Francis Bacon observed, it is also probable that exponential growth of knowledge confined mainly to wealthy countries will exponentially widen the gap between them and poor countries, accelerating the transfer of wealth and resources from the have-nots to the haves. A disturbing vision of this was propounded by British historian Anatol Lieven in his controversial article 'The Second Fall'.[12] Lieven described a world of 2110 in which biotechnology had extended the healthy life spans of the richest one per cent of people to 127 years, and had so soaked up the wealth of the planet in R&D that life spans for the rest of the human race were declining as age-old killer diseases and drug resistance reasserted themselves. There were virtually two subspecies of humans: the genetically modified long-lived rich, and the rest. Lieven likens the situation arising from modern western capitalism of this sort to the rule of conscienceless elites under Stalinism.

A black joke? Not necessarily. In 2002 a survey of 100 top US universities working in health research found that 47 per cent of geneticists and other scientists seeking data or materials relating to published research on genetics from colleagues had had their requests denied.[13] Professor John White of the Australian National University commented: 'Unless you freely exchange information, the whole process of academic life and indeed the whole process of creating new knowledge will fall to pieces. It's a serious matter'.

In its Framework for Action, the 21st UNESCO World Conference on Science in 1999 acknowledged that, while science and its applications are indispensable for development, the benefits are very unevenly distributed across countries, regions, peoples and the sexes. It also observed that while science has great potential for good, it also has great potential for harm and so must be embedded in sound ethical principles. It warned that developing countries, especially those rich in biodiversity and natural resources, require special protection from exploitation by wealthy industrial companies from the developed world. It urged 'better understanding and use of traditional knowledge systems' alongside modern science.[14]

In its closing declaration, the World Conference on Science emphasised four issues:

1. that there is a need for a vigorous and informed *democratic* debate on the production and use of scientific knowledge (authors' emphasis);
2. the benefits of science are unevenly distributed; equal access to science is a social and ethical requirement for human development;
3. that science is indispensable to human progress – but its applications can have detrimental consequences for individuals, societies and the environment; and
4. all scientists should commit themselves to high ethical standards, based on human rights instruments. Political authorities must respect this.[15]

Patenting and IP

Patenting and the exclusive ownership of 'intellectual property' is a thorny and hotly contested issue, and it is not the purpose of this book to resolve it. Yet, since this affects the sharing of knowledge in many ways, both positively and negatively, it may be helpful to advance a few principles:

- the private sector and the market are a most efficient means for sharing knowledge, and for extending its benefits to the wider community. This will be recognised by any effective science communication and awareness policy;
- patenting and IP protection are important ways to ensure a fair return to industry for its investment in the research and development of new knowledge and technologies;

- patenting and IP protection are vital ways to foster continued national innovation; and
- IP protection is an important source of revenue for many research institutions, and a stimulus to further research and innovation and to science/industry partnerships.

However, patenting and IP protection has become a very costly industry in its own right, to the point where protecting a technology may cost more than the technology can return. Patents are sometimes taken out when a commercially shrewder course is to be first to market. IP has also become a tradable good in ways that do not reflect the true value of the knowledge to humanity but rather the adventures of financial speculators.

On the negative side of the ledger, patenting and IP protection conflict with the principle of the free sharing of human knowledge, they exclude large portions of humanity from the benefits of science, retard its delivery or price it beyond their reach, they distort the focus of research from what benefits society to what is profitable for a few, and they undermine community trust in science.

In view of these conflicts and contradictions, it seems sensible to seek a middle ground that aims to maximise the benefits to humanity overall. Some ways to achieve this may include:

- restricting IP and patents to novel scientific applications, constructs and technologies;
- recognising all elements, genes and naturally-occurring materials as the common heritage of humanity;
- recognising 'primary knowledge' as discovered by basic research as the common heritage of humanity;
- building obligations to discuss, inform and educate the community into the granting of IP rights, making the process more transparent;
- encouraging greater communication by patent holders, using effective communication techniques (like those outlined in this book);
- encouraging those who take out patents and protect IP to listen closely to the wishes and needs of society, and to engage in an effective two-way dialogue;
- developing knowledge-sharing partnerships between science, industry and the community; and
- creating an international fund to buy out patents, or recompense their owners, in cases where a protected technology is urgently required to save life and deliver large-scale social or environmental benefits in the developing world.

The great mismatch

At the opening of a century in which humanity is generating knowledge at a pace unprecedented in history, the trend is less to share and more to appropriate and to exclude. On the one hand this may be quite deliberate but, on the other, it is also the result of a simple, unintended, arithmetical imbalance: knowledge is simply growing faster than our capacity to share it. This book is chiefly about ways to overcome this imbalance.

Worldwide, universities and scientific institutions are producing an avalanche of remarkable discoveries, insights and advances. However, their ability to share this knowledge with the community, government and industry rarely, if ever, matches their research capability. Their skills in communicating science come nowhere near their skills in performing it. Many invest 100 or even 1000 times more in R&D than they do in transmitting its fruits and ensuring these are well-adapted to society's needs and wishes.

Some justify this imbalance with the argument that they are research institutions, not communication or technology transfer institutions. In their eyes, their primary role is to discover, rather than to share. Where they do share, it is through the scientific literature and their educational activity, although this reaches only a small part of the populace.

This book is about practical, basic and low-cost ways to share knowledge. It is about how to equip our scientific institutions with ears and a voice to go with the brain and eyes they already possess. It is about developing their understanding and sensitising their consciences about the true needs of the societies they serve.

Sharing knowledge also puts forward a controversial proposition; it is controversial in the sense that few scientific and technological institutions observe it, although, hopefully, most would not disagree with the basic notion. It holds that knowledge is a continuum, running from discovery through reporting, synthesis, development, application, awareness and adoption, and feeding back again at every point. Every phase is equally important.

Today's research establishments are often brilliant in the discovery department, patchy at development, weak at awareness and – dare we say it? – ineffectual when it comes to achieving adoption. The latter task is usually passed to the private sector, a government department, or else not attended to at all but abandoned to fate. One of the most desirable models – a partnership between the research agency, government, private companies and community, is practiced far less than it ought to be.

However, to achieve this requires investment of skill and resources by the original research body.

Our proposition is that *those who invest in knowledge generation ought to invest equally in the other phases of the knowledge continuum if they are serious about seeing their science benefit humanity*. They should consider putting as much time, money, effort, skill and intellectual creativity into knowledge sharing as they do into discovery and development. They should regard those who communicate knowledge as being of equal professional value with those who discover it.

In the 21st century, scientific institutions will be judged not only on what they discovered, but also on how effectively they shared it and how valuable to humanity it proved to be.

Democratisation of science

Earlier we referred to the growing mistrust of science by society, to the increasing significance of ethical issues, to the questioning of the need for change, to the fear of alienation and exclusion. These issues are all capable of being addressed by making science a more democratic, and a less exclusive, activity.

The divergence of opinion between these two is reflected in the common (mis)use of terms such as 'knowledge economy' and 'knowledge society'. Those employing the former tend to see science as in service to the economy, usually in its narrowest sense, as industry. Those using the latter recognise the need for the community to participate in the knowledge process, although there is still a tendency to cast them as grateful recipients of the scientific cargo-cult. Neither approach can ultimately succeed while it ignores the people.

For the true 'knowledge society' to exist there must first be a cultural change within science itself. Its practitioners must recognise:

- that the knowledge possessed by the community in the form of values, beliefs, traditions, morality, feelings and behaviours is critical to the successful uptake of scientific knowledge;
- that 'lay knowledge' and 'scientific knowledge' are equal, and necessary, partners in the innovation and adoption process; and
- that true communication is not about sharing information, but about sharing meaning and achieving a common understanding.

Emphasising the need for democracy in science, the 1999 UNESCO World Conference on Science said:

> *Today, whilst unprecedented advances in the sciences are foreseen, there is a need for a vigorous and informed democratic debate on the production and*

> *use of scientific knowledge. The scientific community and decision-makers should seek the strengthening of public trust and support for science through such a debate.*[16]

The Conference went on to declare:

> *The practice of scientific research and the use of knowledge from that research should always aim at the welfare of humankind, including the reduction of poverty, be respectful of the dignity and rights of human beings, and of the global environment, and take fully into account our responsibility towards present and future generations. There should be a new commitment to these important principles by all parties concerned.*

A British Council international seminar on science and society[17] recognised the need for cultural change within science to full address these issues:

- public involvement in science is made more difficult because scientists don't want – or feel unable – to communicate their work, even though funded by the public and accountable to it;
- scientists worry about how public communication may affect their standing and careers;
- many people in society drop science altogether from their school studies, while scientists have no training in media or how to communicate;
- science cannot be more democratic until scientists learn to communicate better;
- the pressure to innovate through industry is preventing access to scientific results and eroding trust; and
- while science is becoming more global, it is less in touch with local contexts.

Fortunately, a new style of doing science is emerging, says Michael Gibbons, secretary general of the Association of Commonwealth Universities.[18] He describes this as 'mode 2' to distinguish it from mode 1, where the problems are largely set and solved by the academic community. Mode 2 science is seen to:

- better address the needs of society;
- find local and specialised solutions;
- encourage diversity;
- communicate research in advance;
- be more democratic;
- fit with lifelong learning;

- be more effective for the community;
- break down hierarchies; and
- make it possible to share more resources.

UK chief scientist Sir Bob May interpreted the challenge at the outset of the 21st century to be finding ways to foster a dialogue between science and society. In the past, he says, effective dialogues between the public and researchers have been fruitful in helping to identify problems with new research – and in resolving them.

However, Cardiff University's Professor of Journalism, John Tulloch, argues that science has hitherto lacked a deep focus on the nature of communication. He urges researchers to recognise that the public is not a single, homogeneous mass, but a wide range of publics, all with different characteristics and requirements. He is strongly critical of the old-fashioned linear model of science communication that attempts to 'educate' the public about science. Even the 'public understanding of science (PUS)' model attempts to use the media to educate the public. However, journalists working in the media see it as equally important to educate scientists about the public; the media wishes to be a partner in a wider dialogue and exchange about science, not pushing out 'spin' for science.

The British Council seminar concluded strongly that science could and should become more democratic, and that citizens should be permitted to be active partners and participants in the innovation process. Efforts to promote a democratic science need to encourage:

- openness;
- transparency;
- responsibility and accountability;
- independent research and advice;
- negotiation of appropriate technological trajectories;
- meaningful dialogues;
- development of skills and education policy;
- forecasting and resolution of conflicts and crises; and
- equity in the distribution of knowledge and technological solutions.

However, the participants also acknowledge many barriers to achieving this, including the inability of current scientific systems to learn from their failures, to adequately analyse risk and to gather independent advice from all the main communities of interest.

In *Sharing knowledge* we argue that the democratisation of science is not merely desirable from a societal viewpoint, but also from a scientific one. The community can bring to science many ideas and perspectives that will result in the science being more widely accepted, rapidly adopted or commercialised, and of greater value to more people than would otherwise be the case. It can be a partner in the process instead of an uninformed recipient.

Democratisation will help to ease the fear of change, to allay concerns about loss of control or failure of ethical standards. It will reduce the risk of exclusion. In developing countries it will help bring knowledge to poor people far more quickly by engaging them in the process.

This book is a practical, how-to-do-it guide intended to assist scientific institutions become more effective knowledge sharers and partners.

However, we also wish to propose a charter for global science, technology and science communication in the 21st century appealing to all the world's scientists, science managers, communicators and policymakers to renew the essential ideals of science and to join together in bringing it about.

It states:

1. Knowledge is the common heritage of all the world's people.
2. The sharing of knowledge is as important as its discovery.
3. Science will engage the community in a democratic dialogue, each recognising the other as an equal partner in human advancement.
4. Partnership between all nations, developed and developing, in knowledge sharing is central to the peace, well-being, health and sustainability of humanity.

Chapter 2

Developing a science awareness strategy

How many times at a management meeting have you heard the cry: 'We must have a communication strategy!' followed by sage nodding of heads, months of steamy labours for the unlucky person who got the job and endless rounds of nitpicking changes. How many times was there a collective sigh of relief as the whole process came to an end when a thick, unreadable document landed on the table? And how many times was that pretty much the end of the story? The recommendations and plans – good, bad or indifferent – lay untended in their yellowing paper sarcophagus, while the annual report smugly proclaimed the successful publication of yet another strategy document.

This is not to decry the use of strategy in science communication or public awareness but it is to emphasise that enormous time, effort and money is invested by scientific institutions in strategising as distinct from communicating. Some have developed this into an art so rarefied that the production of a new strategy has become a recurrent event and a management goal in itself, while the tactics on which it depends for true success are rarely put into practice. It is more a performance measure for a manager rather than a goal in itself. In its extreme manifestations, the whole thing is outsourced to a high-priced (but usually non-specialist) external consultancy.

The much-abused word 'strategy' comes from the Greek στρατηγος, meaning a general. It describes the general's art, which is to destroy the enemy and to win the war. It is actually not a very appropriate term for knowledge sharing because it embodies the ideas of force, predomination and conquest. Good communication is always a sharing of ideas and meaning, an αγορα (forum or marketplace), in which messages, opinions and information come from all sides, are received, considered and discussed until a common understanding of what they mean is attained. An attractive way of describing this principle is: 'God gave us two ears and one mouth, and we should use them in that proportion'.

Science communication strategy is often subjugated to the desire of the institution to force its message across – almost literally to din it into people's ears – paying little regard to what those people think about the issue or how they may interpret what they are being told. More dangerously still, the strategy is driven by the need of the institution to promote a synthetic public image as if it were a big commercial corporation.

This confusion between how commerce promotes itself (which is perfectly valid) and how science does is growing as science itself becomes more commercial. Research institutions are increasingly finding themselves in the perplexing position of experiencing rising levels of private support – and falling levels of public trust and credibility. Indeed, many science communicators consider that managing this contradiction is one of the hardest challenges science has yet faced.

The unique qualities a scientific institution or corporation possesses are its research discoveries, technologies and achievements. Others may work in the same field but nobody else can precisely emulate these. The core of good science awareness strategy turns on this principle:

> *The public reputation of a scientific institution and its staff rests on the effective communication of its real achievements, their meaning and benefit in a dialogue with society.*

Conventional use of corporate branding techniques to present an artificial, or idealised, image is less effective and may even prove harmful to the institution's public standing, as any hint that its claims are exaggerated or untrue will contaminate public respect for the science and call into question its integrity. Hence it is wiser to communicate the science than to promote the institution.

The first task in designing a communication plan is to identify who are the audiences and what are their needs. This is performed ritually in many cases, and without careful inquiry into what particular audiences actually think, need and expect of their science provider. The people inside the ivy-clad walls sometimes assume, on the basis of their specialist knowledge, that they are also fully conversant with what people feel, think and say outside the walls. To pursue the military analogy, this is like trying to conduct a campaign in the absence of any real intelligence of your opposition's strength, disposition and movements but only on the basis of your own guesswork – a sure recipe for disaster. It is like asking a scientist to do research without data.

Too often the scientific institution superimposes its own needs on the needs of the audience – and the strategy goes off-track from the start. Even if it proceeds to implementation, it will probably not work well.

The most common reason for a strategy's failure is straightforward: the public, even major stakeholders, are not terribly concerned about the institution and its standing or even about the welfare of science. They are much more interested in how its research will affect their lives, their jobs, their health, their food, their incomes, their environment, their freedoms and their prospects. If its achievements are seen to benefit these, the standing of the institution will rise. If not, then it will take a lot more than 'PR' to scotch the notion that Dr Strangelove is at work.

No scientist would (or should) dream of advancing a new hypothesis without careful acquisition and analysis of data. The same applies to communication planning. Seek the audience data first. Understand what it says. Identify your strengths, weaknesses, opportunities and threats as revealed by the data (as distinct from how you may perceive them from an internal perspective). Constantly refresh your understanding of external opinion by new research. The world changes and, unless the institution changes with it, the institution can become isolated.

Another useful way to orient the plan is to identify the key national benefits (social, economic, environmental) that it will deliver, and to test these with audience samples to check they are credible. Apart from the fact that triple bottom line goals are much approved of in the wider community, this approach allows the research body to demonstrate its commitment to the national interest or public good – even if the immediate beneficiaries of the research outcomes happen to be industry or government agencies. Thinking about national benefits and national priorities applies a sensible discipline to the framing of not only communication strategy but also research strategy. It keeps the focus on the high ground rather than technical or organisational aspects.

It should be clear by now why the widely pursued internal committee process for designing a communication strategy does not work. Internal committees often consist of people who know little about communication, though they may be well qualified in other fields. Nonetheless, they *all* have strong views about communication: it's one of those unfortunate skills that everyone with a degree reckons they've got, all objective evidence to the contrary. Internal committees are driven by internal agendas and how they wish their organisation or own role to be perceived by the outside world. In other words, they don't actually want to communicate so much as foster a cherished illusion. Third, because the opinions of the most eminent researchers carry the most weight in scientific bodies, even if they are speaking outside their expertise, the result is usually poor.

Scientists are among humanity's most passionate enthusiasts. They adore their occupation in a way that surpasses most other workers. When you speak to them about it, after being assured of your genuine interest, even the stiffest and most pedantic scientist undergoes a startling metamorphosis into an apostle, even an evangelist. You can't blame them for wanting a say in how their work is communicated. They are seized with a vision of having other mortals experience the joy, exhilaration and enlightenment that understanding a tiny piece of our wondrous universe confers. And they often confuse the wish to share their love of their work with needing to promote the institution they work for.

So, keep the discussion to their work and, where possible, keep most of them away from the strategy unless they are old hands at communicating, because otherwise the temptation to seize the reins will be overwhelming. Better still, pick your strategy advisory committee so that it consists of old hands – and ensure it has some external expertise to douse the wilder flights of fancy (e.g. 'Why don't we get a national TV program on our science, right after the evening news?'). Even then, it is advisable to restrict signoff on the strategy to its principle elements – audiences, objectives and key messages – rather than have the whole thing endlessly haggled over and debauched. Step one in developing a communication strategy for a scientific body is to negotiate the freedom to do this.

When Lord Uxbridge, deputy commander of the Allied army at Waterloo, asked the Duke of Wellington to share his plan for the coming battle, the Duke is said to have replied that he did not have one, as Napoleon had not yet indicated his intentions. Military strategy and communication strategy are alike in that no plan survives first contact. The need for flexibility, fluidity and constant intelligence of what is going on are paramount. A detailed, step-by-step, carefully timetabled plan is a straitjacket. It will have you making your grand scientific announcement on the day the General Election is called, a plane crashes or a war breaks out. It will advertise your irrelevance to the immediate concerns of society. It will reinforce the widely held impression that scientific institutions are mediaeval monasteries, shielded against the world outside and remote from its cares and concerns. This will undermine the disposition of taxpayers, governments and companies to give you money for research. More importantly, it will hinder your efforts to share knowledge because society will be loath to take on trust new knowledge from an institution that appears to be out-of-touch.

There is, of course, a place for timetables in a communication strategy, especially if you are pursuing an approach whereby successive announcements build on one another, or if you have a deadline event. However, it must be borne in mind that these can easily be derailed by external happenings. It is more effective to try to time your announcements for moments when the public, industry or political debate is focused on a related issue or when it is subdued. That is when media, government, industry and the public will be most receptive to what you have to tell them. To be avoided at all costs is having your communication plan driven by internal management needs (such as achieving goals by a set date so that a report can be made to the board) at the expense of effective communication that is sensitised to the needs of the audience.

Designing a plan

Designing a communication or public awareness strategy is not a mysterious art. It need not cost a fortune or take months. It should not be long and tedious. The best ones are concise, compelling and dynamic: a few pages at most. They are simple, logical and easy-to-follow. They enable basic communication activities to cascade through the organisation, involving staff right down to individual project level in straightforward activities that are effective. They teach, lead and guide rather than prescribe and enforce. Above all, they encourage the organisation to use its ears, gather external feedback, develop the skills to interpret it and respond intelligently.

Here are the basics. The exact order may vary according to the situation:

1. **Define your overall communication goal(s)**. Make sure they are practical, achievable and can be evaluated in some way.
2. **Identify target audiences**. Find out what it is they want or expect from your science. Find out what they know and don't know of your work. Find out how they would prefer information to be delivered so they can use it.
3. **Segment audiences** into key groups requiring different communication methods.
4. **Work out the relationships** you wish to have with each audience. Relate them directly to your institution's overall goals or business plan. Aim to build trust and mutual understanding.
5. **Decide key messages**. These depend on the audience's outlook and will vary from one audience to another. They should be few, simple and should either be overt or implicit in all communication activities you undertake with that audience.
6. **Choose your tactics**. Based on your research with each target audience about its needs and preferences, work out the most effective

ways to reach them and to engage them. Make sure communication runs in both directions wherever possible, and that there is provision for feedback.

7. **Identify the resources** (finance, staff, external skills, equipment) you need for each tactic, and budget them. Timetable where appropriate.
8. **Develop ways to evaluate** how your program is going to correct anything that seems not to be working and replicate tactics that prove successful.

The following table offers one possible structure for an organisational communication plan. The upper part is the bit that receives signoff and should remain consistent over time. The actual tactics (or initiatives) are the part requiring flexibility and imagination to cope with shifts in audience opinion and external circumstances.

Communication Plan

Purpose

A concise statement of the purpose of the institution – its vision or mission statement – expressed in terms relevant to external audiences and stakeholders

Strategic objectives

A list of the Institution's strategic or business goals

Communication objectives

Goals for the organisation's communication activities

These underpin and support the strategic goals, above

They reflect the needs of customers, audiences, partners and stakeholders, as well as the organisation itself

Communication plan

A short statement of the main principles and methods by which the above goals will be achieved

Principles	***Key elements***	***Ethos***
Principles that all communication activities will observe	Describes briefly the key elements of the plan	Core beliefs of the organisation it wishes to project externally

Target audience	***Target audience***	***Target audience***	***Target audience***	***Target audience***
Government	**Industry**	**Internal stakeholders**	**Public**	**Research partners**
The main audience should be carefully segmented into key subgroups	Segmented into different industry groups, professional bodies, geographic targets etc.	Especially staff, scientists and other professionals	Segmented into groups such as general public, consumers, gender, age group etc.	Other universities and research agencies, government agencies, funding agencies, scientific bodies.

Relationship	***Relationship***	***Relationship***	***Relationship***	***Relationship***
Define the relationship you wish to have with the target audience (based on market research)				

Key messages Messages based on audience research and the viewpoint (and language) of the research user	***Key messages***	***Key messages***	***Key messages***	***Key messages***

Initiatives A list of all activities and tactics designed to communicate with the target audience and its segments: • face-to-face • publications • electronic • media activities • advocacy	***Initiatives***	***Initiatives***	***Initiatives***	***Initiatives***

Measurement Measures by which the success or failure of individual initiatives can be measured. Often includes market and stakeholder research	***Measurement***	***Measurement***	***Measurement***	***Measurement***
Budget Funding allocated to each activity in this part of the communication plan. Revenue sources	***Budget***	***Budget***	***Budget***	***Budget***
Timeline Deadlines and dates by which certain tasks are to be accomplished	***Timeline***	***Timeline***	***Timeline***	***Timeline***
Staff and resources Staff and resources, including external, allocated to this part of the plan	***Staff and resources***	***Staff and resources***	***Staff and resources***	***Staff and resources***

Strategic objectives

These are the goals stated in the institution's strategic or business plan – its purpose, mission and specific goals. They go at the top, because the communication strategy is derived from them.

However, and this is a serious warning, organisational purpose, mission, vision and goals should not be developed without careful thought given to how they will appear to, and be received by, the outside world. Many institutions fall into the error of setting themselves missions and goals that sound well within the institution but look appallingly self-interested and out-of-touch when viewed externally. In other words, communication principles (what do our publics and stakeholders expect of us and how do they value us?) should always guide the formation of institutional objectives, not *vice versa*. Public perception needs to be integrated into the organisation's overall planning and management from the very start.

Communication, both internal and external, is intrinsic to management and cannot simply be added on after management has decided where it wants to go. Media analyst Jim Macnamara describes the persistent failure of managements to grasp the function of communication as the 'wheel-trim' syndrome: you can add all the drag-stripes and fancy paintwork you like to your car, but they won't make it go any faster. Only if improvements are built into the actual engineering of the vehicle will its performance be enhanced.[1]

International mining industry public affairs authority George Littlewood adds:

> *Too often the business of managing public perception, and therefore the public clout of the organisation, is in reactive mode, driven by day-to-day events, not long-term planning. It is far more important to do the opposite, to be proactive. The key is to listen to what's going on external to the organisation.*
>
> *It is about engaging both critics and supporters and, importantly, it is about the public affairs function being the sophisticated and penetrating eyes of the organisation. What is going on in the wider world must be better understood within the organisation so that its response and its management can be better tuned to external pressures.*[2]

Communication objectives

These are the actual goals for the organisation's communication activities: what it wishes to achieve in the way of enhanced standing with various audiences, increased awareness of its capabilities, more research partnerships, more effective sharing of its knowledge with customers and society.

Communication objectives mirror the organisation's strategic or business objectives. This is not difficult when the latter have been carefully conceived with external audiences in mind. However, communication objectives will often add up to wishful thinking in cases where the overall strategic plan comes from a self-centred perspective that ignores the reaction of the outside world. A plan based upon fantasy is bound to fail.

The fundamental rule is to reflect not only the interests of the organisation in setting strategic communication goals, but also the interests of the customers, stakeholders and the public. The business terminology for this is to link external communication with shareholder value, but the principle is much the same.

However, science must usually serve two distinct stakeholder interests simultaneously – the interest of the immediate customer (perhaps a company or a government) and the interests of the wider community. Sometimes these conflict, and the institution will be compelled to ask itself where its true loyalty and obligation lies. In a world of tight funding for science, the overwhelming temptation is to follow the short-term dollar, but as has already been shown, this is leading to a crisis of trust for science and its reputation for caring for the public good, which in the longer term may erode both public and private support. This accentuates the importance of Littlewood's point about setting communication strategy goals for the longer term, rather than reacting to immediate circumstances – but having flexibility in tactics to cope with new developments.

It is not as hard to reconcile the interests of commercial customers with those of the wider public as might be imagined. This issue is dealt with more fully in Chapter 5.

Communication plan

This part of the plan states the main methods and principles by which the communication objectives will be achieved.

It consists of a few concise but clear statements of purpose, or broad objectives, for the communication strategy.

For example, in the case of a scientific organisation such purposes might be:

- to help reduce degenerative disease by providing better information about nutrition and exercise;
- to enhance economic growth by developing and communicating more efficient production and processing techniques;

- to introduce industry to new environmentally-sustainable technologies;
- to influence public behaviour towards a more conservative use of water and energy; or
- to influence government and industry to adopt a more scientifically sound greenhouse policy.

Having selected a few key communication intents it is then important to state the principles, key elements and ethos on which they are based. The reason for this is that all human decisions are based on a combination of rationality and emotion: it is essential to acknowledge the emotional basis of one's intentions as well as the objective basis because it provides the mainspring of motivation.

In an organisational communication strategy they may comprise:

- a vision statement (what, idealistically, we hope to achieve);
- a statement of principles;
- a statement of ethos or core beliefs of the organisation that we intend to display through communication; and
- a statement of key elements (broadly, how we intend to go about it).

Target audiences

The next step is to identify target audiences, markets or 'publics'. In communication, there is no single 'public'. There are scores, possibly even thousands, of different publics, all of whom react differently to information presented to them and who have special needs and interests of their own, often widely differing from one another. A classic case is the contrasting attitudes of industry, government and environmentalists to, say, greenhouse issues. While the science is the same for all, the way it is interpreted and communicated may be quite different for each audience.

In a communication plan for a scientific institution, typical broad audience categories are:

- government;
- industry;
- the general public;
- external research partners;
- staff and key stakeholders; and
- non-government organisations.

However, within each of these categories there will be quite distinct audience groups. The public, for instance, may consist of consumers, householders, males or females, the young or elderly, urban or rural dwellers, employed or unemployed, and so on. Each group may need its own opinion research, messages and communication techniques.

The next step is to work out what relationship you want to have with your particular target audiences. Do you wish to engage them in discussion, inform and raise awareness, increase the uptake and application of a technology, or generate more investment in research? Once again, the relationship should be defined in terms of the audience's needs, as well as those of the research institution.

The critical move is to research the audience to find out their needs and expectations from your work, what they know and don't know, how they prefer to receive information in a form they can use, and so on. Usually this is done by polling, by one-on-on interviews and by focus group work. Different techniques are discussed in Chapter 12. Failure to do this research at the outset will limit the success of the communication strategy. It is like trying to perform science without acquiring data or taking measurements. Science organisations sometimes shy at the cost of this vital step, but one way to get around this is to point out that the cost of the research can be offset by holding far fewer committee meetings, which would otherwise waste precious staff time in devising inappropriate and ineffectual strategy.

Key messages

These are the things you want to say constantly and repetitively to your audience, in different ways and either directly or implicitly, in every communication you have with them.

They come firstly out of the target audience research, and then out of the overall communication objectives. To neglect the first will be to cripple the effectiveness of your communication effort. It may leave your organisation looking propagandist and self-centred.

For example, in speaking with consumers you discover they have a great anxiety about the need to improve food safety and purity. In speaking with your staff you discover they have a great anxiety to be seen to be doing brilliant research. If only the second point emerges in publicity it is likely to miss the mark with consumers, who generally don't care about research and have no way to judge its brilliance. However, by structuring the communication strategy so that the key message speaks of discoveries and advances that significantly improve the health and safety of food for consumers, both goals can be achieved. The public will be satisfied, and there will be praise and recognition for the researchers. This may seem absolutely obvious, yet it's amazing how often it is overlooked.

As politicians and media editors have long known, a secret of effective communication is to give the people what they want to hear, but to encase your own message within it.

This applies equally in communicating with industry or government. Research among politicians may reveal their prime concern as being how to demonstrate to their electorate that they are doing a good job in order to secure their re-election. Your scientists, as before, want to show that they are doing great work. The solution may be to try to identify the political benefits in the scientific success – how many jobs it created, how many lives were saved or improved, and what the gains were to the local community. These are the sorts of things that politicians delight in taking ownership of, and in sharing the credit with the scientists who actually made the discovery! As a bonus, the politician then becomes a *de facto* messenger for the science communication team.

A company facing steep local or foreign competition may be primarily concerned about its ability to compete. What it is looking for from the scientific institution is that its researchers have the ability and track record to give the company an edge in the marketplace – not that they are producers of elegant science. These examples reinforce the principle that *the key message must be drawn from the perspective of the research user, not the research producer.*

There may be one key message or several. All should be simple, clear, non-technical and customer-focused. Too many messages may cause confusion for the audience.

These messages will be delivered, in different ways, in all communication with the target audience, be it verbal, printed, implicit in media coverage, encased in submissions, reports, brochures and marketing material, on web sites and even on corporate gifts and greetings cards.

Feedback from the audience should be encouraged so that the key message can be continually fine-tuned in keeping with shifts in external opinion and customer demand. Changes in customer opinion and the key message must also flow back up the research chain so that they can be factored into the R&D itself and help to iron out bumps and potholes in the pathway to adoption.

Communication initiatives

These are the heart of the communication strategy and cover the full range of activities designed to convey information or impressions to the target audience and to gather feedback.

They may employ the familiar tools of glossy publications, mail-outs and advertising, they may cover face-to-face and interpersonal approaches, modern technologies such as the web and multimedia, or they may use indirect means of reaching the audience such as media coverage, advocates and ambassadors. They will be dealt with more fully in later chapters, but some useful general points follow.

Publications

Publications consist broadly of brochures, handbooks, directories, annual reports, leaflets, capability statements, fact sheets and calendars. They are a good way of presenting the organisation's identity, capabilities and achievements, but they are also grotesquely over-used. Their first drawback is that they rely on the recipient having the time and interest to read them carefully, which is not always the case in a world awash with information. Their second drawback is that they are, all too often, designed to pander to internal corporate ego rather than to inform the external recipient. Their third drawback is that, in presenting too slick a corporate image of the institution, they may in fact undermine trust, credibility or its image as a cost-effective operator. Private companies funding R&D are especially allergic to the thought that some of their investment may be sidetracked into corporate hype; funders don't like their money being spent on promotion; while environmental groups are ideologically opposed to waste.

It may be that scientific organisations suffer from publication-mania because it is the scientific paper that gives substance to the work of research, so the corporate handout is seen as somehow giving substance and credibility to the institution. Generally, when faced with a communication task, the Pavlovian reaction of scientific managers is to demand a brochure. These are churned out with a freedom, a frequency, at a cost and with a wastefulness that would be considered shocking in a private company. Scientists, it may also be argued, are among the world's great environmental vandals when it comes to an enthusiasm for felling forests in order to satisfy their craving for corporate glitz.

The rules for a brochure costing thousands of dollars are no different, in essence, to the rules for launching a national newspaper costing millions of dollars:

- Who is it aimed at?
- Do they really want it?
- Will they read it?
- What is the competition for reader time?
- Is it the most efficient way to deliver the organisation's message?

- Does it fit the communication strategy?
- What is the cost/benefit of doing it?
- How will we know, objectively, whether or not it is working?

Science organisations, usually so sparing when it comes to spending public money, seem to experience a rush of blood when it comes to corporate publications. They churn them out willy-nilly, on a management impulse, without discipline or analysis, at a cost of tens of thousands of dollars each time. One of the communicator's hardest tasks is pouring cold water on corporate enthusiasm when in full cry for yet another pointless but ego-gratifying publication.

Face-to-face communication

Face-to-face communication is almost always the best and most effective way to get a message across, listen to the audience and build the relationship. It may consist of one-on-one meetings, larger gatherings such as advisory bodies, seminars, workshops, exhibitions and presentations all the way to major conferences. Its greatest advantage is that it allows knowledge and opinion to flow both ways.

For it to be truly effective, however, the scientific institution needs to have highly developed listening skills, negotiation skills and presentation skills. Some scientists have told us that among the most satisfying meetings they have ever attended were ones in which the scientists never spoke a word, but simply received the views of their research partners and external people and took note of them. This 'biting the tongue' technique is not only educational for the recipients but it also transmits an enormously positive message about their openness to others' views, needs, criticisms and preferences. Helping one's interlocutor to feel 'heard' is one of the most important skills in modern science management and communication. Even more importantly it recognises the knowledge that exists in industry, government or the community, validates it, and places it on a plane of equality with the knowledge of the scientific body. This is an absolutely critical step in reaching a common understanding, enabling knowledge sharing to speed and smooth the adoption of scientific findings.

One great but rarely used opportunity for the science community to communicate face-to-face with external stakeholders is the futures conference. Practically everyone has an interest in the future and some sort of view of it, whether they regard it as a threat or a promise. Much of the public's fascination with science lies not, as many scientists fondly believe, with an intrinsic interest in the research, but more in a kind of horrified anticipation of what is coming next: what new toxin will appear in our food; what disease or pollution scare will surface; how will new technologies change our lives for the worse as well as the better, or demand the effort of painfully acquiring new skills; or how might our jobs, communities and values be threatened by technological change?

The futures conference explores scenarios, both good and bad, that science predicts on the basis of its latest advances, discoveries and insights, and combines them with what industry and the community imagine and wish their futures to be like. Its value is to help people to prepare themselves for the future by sharing their impressions of it, and begin the process of adopting scientific findings by giving thought to what is coming their way. The value to researchers is that these conferences can flag unanticipated social, ethical and other concerns about the science, in time to do something about them, as well as making them more conscious of public needs and wishes. They are also valuable for identifying novel applications of science not yet contemplated by researchers.

If a university or large science agency were to hold futures workshops across the full range of its departments or disciplines, it would probably come close to developing an interesting blueprint for national or regional development – a road map to the future.

Electronic technologies

Electronic technologies offer an avenue for providing, acquiring and exchanging knowledge on an undreamed-of scale. They include television, video, radio, the internet, email, mobile communications, electronic conferencing, virtual workrooms, multimedia, games, haptic devices, holography and the like.

They have the virtue of being able to reach thousands or even millions of people, but the have the disadvantage that many of these technologies are entirely optional on the part of the recipient. They are not, for example, all that precise a way of communicating with decision-makers and opinion leaders, who are usually too busy to surf the web, check email or watch hours of television. Despite various advances in the interface, they are also impersonal and lack human warmth and interaction. They still pose problems with the key goal of communication: achieving shared meaning. Many are dominated by giant corporations whose motives and intentions are suspect to the community. Some also have the drawback of being alienating to certain classes of user, such as the elderly, technologically-phobic, and the vision or hearing-impaired. Of course, they do not reach the poorest and most needy members of the human race, who have most to gain from having greater access to knowledge.

This raises the moral question of whether the wonders of modern electronics and mass communication bring greater equity or merely sharpen the distinctions between the haves and have-nots.

One of the most attractive features of electronic communication is its cheapness compared with face-to-face techniques or publications. However, it is also quite hard to measure the impact of broad-scale electronic communication, and therefore to establish its true cost–benefit relative to other methods. Web 'hits' do not measure information absorbed and subsequently used by the reader, and neither do TV ratings surveys. On the other hand, email contact and virtual conferencing can be very precise and generate useful feedback. A sound course is to employ electronic communication as part of an overall spread of techniques for reaching particular audiences; it is the shotgun to accompany the sniper-rifle.

Indirect advocacy

Indirect advocacy is when another individual or organisation carries your message to the target audience. This can apply to a story run in the media, a satisfied customer speaking to their peers, a politician sharing credit for your work, or a famous or influential person recruited to promote your work or press your cause.

As detergent companies have known for generations, it is also highly effective, because your message comes with someone else's endorsement and avoids the appearance that you are merely blowing your own horn. One of the mysteries of the modern media is that while people affect to despise it, they also have a tendency to credit what they read, hear or see in it, and the fact that your story appeared in the paper is likely to do more for your credibility than telling it yourself in a handout.

To make best use of it, indirect advocacy involves achieving optimum credibility in both message and messenger. However, both must be carefully chosen to suit the audience at which they are aimed. For example, a rock star may have far more credibility with a youth audience than a Nobel laureate!

Measures of success

Measures of success are an important way to test the effectiveness of your tactics, and of your overall strategy. They are also important in demonstrating to the institution that its investment in public awareness is paying off. Ideally, they should be expressed in quantitative as well as qualitative data. This is because *scientists trust numbers more than they do words or images*.

Measures of success can range from evidence of greater awareness among certain audiences, to customer satisfaction ratings, increased adoption of advice or technology, and greater public and political consensus on a way forward.

Many people use a 'value of publicity' assessment, which attributes a dollar advertising value to the volume of media coverage achieved. While the numbers can be impressive, this is generally not the most appropriate tool for expressing the effectiveness of a science communication activity. After all, what does the fact that you gained $1 million worth of free publicity actually tell you about the uptake or use of knowledge?

Measures of success are *not:*

- 'we produced a brochure';
- 'we issued six media releases';
- 'we gave five presentations to industry'; or
- 'we created a web site'.

These are merely measures of communication output, not of success. They don't tell you a thing about what the outside world made of you and your work.

Program and project communication strategy

An essential element of an organisational communication strategy is that its principles, objectives, messages and tactics cascade downwards within the organisation like a fractal series. The communication strategy for a large scientific program, or for a small scientific project, should be miniaturised versions of the overall plan, fine-tuned for particular audience needs.

Negotiating this across a large organisation can be one of the trickiest tasks because some scientific cultures (e.g. sociologists, agricultural scientists, astronomers, environmental researchers) are habitually talkative and communicative, while others (e.g. earth scientists, mathematicians, physicists, engineers) tend to introversion and an anxiety that 'nobody understands what I do'. Some disciplines have a high public interest focus, while others observe a culture of commercial confidentiality (sometimes, alas, employed as an excuse not to communicate). The best move is to design several simplified copies of the plan according to the different needs, skills and communicativeness of the various departments, units or teams.

The principle here is: *to achieve optimal awareness of its value to society, a scientific institution should seek recognition for all of its work, not simply for a part of it.*

Most institutions are more renowned for one field of activity than for another. They may have a high profile for their medical research but a low profile for their metallurgical work, even though the latter may be just as excellent as the former. Good strategy will aim to preserve the high profile for medicine while enhancing the profile of metals research.

Metals may, at first glance, seem a lot less sexy than developing a new cancer therapy but they too save and enhance lives, create jobs and income, give rise to new tools and technologies and things the community can relate to. All that is required is a bit of imagination in how the work is explained, and a rigorous focus on application and its consequences.

Developing a communication plan for scientific programs and individual projects follows the same basic steps as for the organisation, although it may be far less elaborate and use fewer tactics:

- define the communication goal(s);
- identify target audiences and their needs;
- decide key messages;
- choose your tactics and timetable;
- identify the resources and budget; and
- devise a way to measure results.

It is highly desirable for there to be a requirement to communicate the outcomes of research placed on every program and project, and to ask each scientific team to go through the process of thinking about how it is going to deliver its findings or achievement to various audiences. This is not only good for communication, but good for science and for the research process. In particular it is helpful to the ultimate goal of sharing knowledge and successfully transferring technology.

It ought to be mandatory for universities and other institutions operating under a competitive grants regime to include a basic communication plan in their grant application, and for its implementation to be a condition for obtaining future grants. In block-funded institutions it is necessary for management to send clear signals throughout the organisation that teams and individuals are expected to communicate. Ideally, this would be coupled with a system of incentives, rewards and promotion. While scientists may at times resent such requirements, they are in truth no more than basic accounting to the society that provides their funds and salaries and a form of 'report to the shareholders'. Scientific bodies wishing to maintain or increase public funding of their work need to be especially mindful of this.

One way to encourage communication plans to cascade downward in the organisation consistently is to develop a position statement in the overall strategy, with which subordinate communication plans comply and are consistent. This should observe closely the organisation's overall strategic objectives and the goals of its communication plan.

A critical element in developing awareness plans for individual research programs and projects is to have communication expertise available to guide the process. Although most institutions employ a science communicator, they are normally few when compared with the number of projects to be communicated or the number of scientists requiring advice and assistance. This is one reason why it is highly desirable to equip scientists with the particular skills needed to communicate their own work more effectively to different target audiences, such as media, government, industry and the general public. Part of developing an awareness plan for a scientific project consists of identifying who in the team will make good spokespeople, and then ensuring they have the necessary training to do the job with confidence and skill. The old model of always using the team leader, and invariably trying to communicate on the spur of the moment, off the top of the head, without forethought or planning, is no longer good enough.

It should be noted here that universities are generally ill-equipped when it comes to science communication skills. There is a public affairs office, whose task is mainly to promote the institution and its educational function, but few employ a trained science communicator, let alone several. The result is a media office that funnels inquiries to various departments and units, but does little in a proactive sense to help them develop sound communication plans and practices of their own, and to listen to the outside world about scientific issues.

In countries where universities struggle for funding, one of the main causes is their lack of skill when it comes to conveying their real value to the wider community, government and industry. Many university systems, somewhat complacently, assume that their contribution to society is self-evident and that only a fool wouldn't see it. This is not always the case, especially where politics is concerned, as Chapter 4 explains. A lack of funding and support for universities and research systems stems primarily from their own failure to convey to society the genuine contribution they make. Since the society is broadly unaware of it, it exerts no pressure on politicians to resource the research enterprise better. Politicians, who like to spend money on things that will get themselves re-elected, are thus under little compulsion to give high priority to universities and research agencies.

As will be explained later, a distinction needs to be drawn between corporate PR or image-building, and science communication that transmits real achievements and gathers feedback. The public, governments and industry are far more prone to invest in a body that both listens well and produces outcomes of real worth than in one that is merely polished when it comes to spin. For this reason it is essential that universities and science agencies employ more people with the skills and experience necessary to do this. As a rule, whining will not generate greater support – but telling a good, accurate story about your work in a compelling and relevant way will.

Chapter 3

Communicating with the media

Like oil and water, scientists and journalists seldom mix. Each profession has a tendency to view the other in terms of stereotype, yet each is essential to the other. Like science, the media is about ideas. It is a natural forum for the discussion and debate of new scientific findings, and their dissemination and acceptance by society. To the journalist, science is a never-ending source of news – not only about discoveries, but also about the application and meaning of science for society and the inevitable controversies that surround these. Journalists and scientists are thus partners in the sharing of knowledge, although they do not always regard themselves in this way.

What hinders the partnership on so many occasions is the retention of stereotypes. To journalists, the scientific archetype is the wire-haired male boffin with the slightly-mad glint in the eye, the weird alembic and incomprehensible vocabulary. To the researcher, the stereotypical journalist is a wolverine, red in tooth and claw, jamming a foot in the lab door before ruining that scientist's reputation before the scandalised gaze of their colleagues and the world at large. Like all stereotypes, these fail the test of genuine experience yet it is remarkable how many in both professions cling to them, especially those unacquainted with the other's world.

Nonetheless, scientists and journalists inhabit very different cultures and observe contrasting imperatives, as the following table suggests:

Scientists prefer:	Journalists prefer:
Detail, data, method	Application: what it means to people
To be rational, cool and objective	Emotion and drama
Teamwork and shared credit	Heroes, not teams
Incremental progress	Breakthroughs (hot news)
To qualify their views	Controversy/conflict
To consult peers	Clear, crisp comment NOW!

One of the science communicator's arts is to blend this improbable mixture, to help each to appreciate their value to the other, to understand the needs of the other and the benefits that flow from an effective working partnership between science and journalism.

There are also profound social, economic and environmental gains to be made from a strong relationship between science and the media. Science is about the creation of knowledge and ideas. The media is about sharing, debating and testing ideas in society's marketplace. That is where the interests of the two intertwine.

Partnership between science and the media is essential to an advancing society.

By transmitting new knowledge, or at least the awareness that new knowledge exists, this partnership helps people to improve their lives more rapidly and effectively. It empowers individuals. It is a potent means for tackling poverty, ignorance and disempowerment because it helps to provide people with access to the information they need to take charge of and enhance their own lives. It enables people to dip more freely into the well of human knowledge and select the things of most value, relevance or interest to them. It assists governments, industry and leaders to make better-informed choices and decisions.

It would be rash to assert that the media is indispensable to all scientific progress, as there are many cases – including the atomic bomb – where it wasn't. But virtually nothing significant in science is free from media scrutiny at some point, especially at the point of application. And there is little in science that does not actually profit from this scrutiny, whether it is simply society being made aware of the advance, helping to find a commercial partner or assisting a government to formulate sound policy.

Moreover, the media can make scientists aware of unforeseen consequences of their research – whether it has potential for wrongful application, whether it is out-of-step with social and moral values, whether it can be enhanced by being presented in a different technological package. The media lubricates the successful uptake of new knowledge, and helps society move more rapidly and with greater agility towards sustainability, economic and social progress. In countries where education is mostly devoted to the young, the media is the main means for providing the majority of people with access to information and new knowledge.

However, the media is not about giving society a classroom science education, nor even bringing about a fundamental improvement in national scientific literacy other than in the broadest sense. Mostly, it will focus on the application and the meaning of science to society and ordinary people or on its dramatic, controversial and amusing aspects, rather than on the technical detail of research. Because of this, some scientists treat the media as an obstacle, or at least an inconvenience, to their work.

Since the end of the Cold War, people in modern democracies are insisting they be informed about new ideas and new technologies before they decide to accept, adopt and use them. The justification of secrecy as being 'in the interests of national security' no longer seems so cogent an argument. When it comes to new technologies, people wish to ask the tough questions, listen to and be persuaded by the answers. They wish to witness the debate, and be assured that their main concerns about safety, ethics or the environment as well as cost, control and practicality, have been addressed or at least taken into consideration. They are increasingly intolerant and resentful of the old, patronising 'science knows what's best for you' model.

Humans are forgivably risk-averse. We have spent the past three or four million years in the development of a marvelously sophisticated system for identifying, confronting and limiting the dangers that surround us. It is one of the secrets of our evolutionary success. This is the main reason why the media often seems to be full of bad news: not because journalists like it that way, but because readers and audiences demand it and the media that ignore this demand soon go broke. Finding out about danger is a human survival trait. People want to assess the risks so they can set in train the social mechanisms to neutralise them. Scientists are particular beneficiaries of this process as they are often paid by society to do research that reduces risks, that helps make our world a safer, cleaner, healthier and greener place, or simply helps us to appreciate what is going wrong and how to mend our ways. Often these risks first come to public attention through the media, and their presence in the media is a clear signal to politicians that it is time to act. The political response is frequently to direct more resources to science in order to minimise the perceived risk. Astute scientists take advantage of this.[1] So, next time you wonder at the media's apparently insatiable and gruesome appetite for food scares, cancer threats, pollution hazards, accidents, plagues, crime rates, climatic shifts, fires, crashes, floods, mortality rates and daily disasters, one way to view it is as more work for the research profession.

There is a feedback loop between science and society, much of which is provided by the media, which enables the ideas, concerns, criticism and debate to pass to and fro. A few scientists, intimately familiar with every aspect of their field, are impatient of this process, hankering for a yesterday when authoritarian regimes simply decided what was good for the people and the people did as they were told.

In the 21st century, however, we are entering the age of the democratisation of science, when people not only demand a say in the outcome and how it is used, but in the very science itself and how it is performed. It is an age when good science will be judged not only by its scientific quality but also by its social acceptability, and when people will be equal partners in the development of new knowledge and technologies.

The media is a primary target for science because it reaches all the other audiences – decision-makers, opinion leaders, professionals, industry, partners, competitors and the community at large.

An error sometimes made by people with scant media experience is to regard the journalist as the target of their message, whereas in fact the journalist is only a channel through which the message must pass in order to reach decision-makers or the wider public. How accurate that message turns out to be depends significantly on how much effort was spent on ensuring accuracy in the first place. The precept 'Seek first to understand and then to be understood' is useful.

When approached by the media for comment, there is a tendency on the part of many researchers to do the interview without much forethought or without preparing clear background material. Then they are amazed and offended when the story turns out to be inaccurate.

The good news is that this does not need to happen. To a very significant degree, the researcher or scientific institution can help the media to 'get it right'. With care and forethought they can make the media their partner and their vehicle in delivering a scientific message to the wider community and in exchanging information. However, as in all human relationships, the key ingredient for this to occur is trust.

The journalist must be able to trust the scientist that what they are being told is truthful, correct and not self-seeking, because the journalist rarely has the time, specialist knowledge or resources to validate a scientific claim objectively. The scientist must be able to trust the journalist that his or her work will be fairly and truthfully reported, without exaggeration, distortion or misrepresentation. Such a relationship of mutual trust does not spring up during a single interview. It requires time, repeated contact, and understanding of each other's needs. It profits from contact at an informal, human level as well as the professional level.

Where this happens, the relationship can be extremely fruitful for both. Accurate science reporting not only brings the scientist's work to the attention of policy-makers and the public, it also brings it to people wishing to fund research or invest in its commercialisation. And, unexpectedly, it can bring it to the attention of other scientists working in related fields. A growing number of scientific collaborations, especially international ones, begin when the partners become aware of one another through a report in the general media. A valuable but intangible benefit of good science reporting is a boost to the morale of the research team due to public recognition and social validation of their work. Sometimes, too, experienced journalists can contribute real value to science from the breadth of their experience by suggesting ways for its adoption that are likely to be more politically or socially acceptable, or unexpected applications in unrelated fields.

The journalist who cultivates scientific contacts over time discovers an ever-refreshed fount of news stories. He or she also benefits from reliable tip-offs received from researchers about issues that at first may seem to hold minor significance but that grow to assume national, even global, importance. For the journalist, regular contact with scientific institutions and their staff produces the things that further a journalist's career – exclusive news breaks, broader contacts, a wider information base, insightful analysis, and clues to new directions in which society may move.

In developing countries, where freedom of the press is in the process of emerging and democracy is by no means guaranteed, a strong relationship between science and the media is of particular importance. This is because the effective sharing of knowledge with the wider population gives them greater opportunities to improve their incomes, skills and well-being. All of these are basic foundations for economic progress, successful democracy, free speech, a free press, and social and political stability. Science provides the media in developing countries with a plentiful source of stories that are not politically controversial but that help the society to achieve more rapid growth, progress and stability.

The key contention of this chapter is that *the journalist and the scientist are partners in the process of knowledge generation and sharing. Each can add value to the other's work.*

When they work well together, the process of knowledge sharing and adoption goes more smoothly. However, there is another reason for their collaboration: the scientist is usually highly focused in a particular field. The journalist often has a very broad general knowledge, widespread contacts across society and its opinion leaders and a 'big picture' view of the world. When these two worldviews are combined, the results can be extremely rewarding for both, and for society.

Here are some basic principles for developing a stronger working partnership between science and the media.

Understanding journalists

Journalists are as varied a group of individuals as scientists, many of them just as bright and occasionally, brighter. Usually they are a worldly bunch with a developed sense of how changes or discoveries are likely to be received by the community, or by sections of it.

As a rule:

- Journalists are mostly in a hurry, with a deadline to meet. They want to get straight to the point and not beat around the bush.
- Journalists are inquisitive, probing and shrewd in how they obtain information. They are trained to uncover secrets and to detect untruths. It pays to be prepared, tactful and polite in dealing with them.
- The curiosity of a good journalist knows no bounds. It will often outrun the scientific data available, but nevertheless requires answers.
- Their focus is on their reader or audience and what these will make of the story (although it may also be on the editor and what he or she interprets as the interests of their audience).
- A journalist is neither the inferior nor the superior of a scientist – both serve the society in different and special ways.
- Journalists deal with the high and low in society. They are less impressed by rank, status, position, honorifics, awards and qualifications than other people, and more by genuine human qualities and abilities. They often have highly developed ways of summing people up.
- They work for money and the media is in business to make money. A science story will often be assessed in terms of its significance to the public and its capacity to generate an audience for the media. The size of that audience governs the income of the media, because advertisers pay to reach particular audiences with precision.
- Like good scientists, good journalists are cool, detached and objective in dealing with the information they gather. They are rarely there to praise or condemn, but to report and sometimes analyse.
- Journalists are interested in people as well as facts. Their profession thrives on human interest stories within and around the news. They seek the human or emotional side of a story because that is what their audience is also interested in.
- Journalists don't enjoy being made a fool of, or being treated with disdain, any more than scientists do. However, because of their access to the public they can do a lot of harm to any person or institution that

offends them or whom they decide is contemptuous of the public interest.

- The scientist and the journalist are equal partners in a free society and in the process of sharing knowledge. The relationship should be one of trust, mutual respect and collaboration.

There are two kinds of journalists. Generalists may be reporting on a fire one moment, a social event the next, a movie star after that and an industrial strike or political rally later on. Specialists cover a particular area such as politics, economics, business, medicine or science.

When dealing with a general reporter it is important to take the time and trouble to fully explain the background of the research to be communicated. No prior knowledge should be assumed on the journalist's part. Even if the journalist does have some understanding of the issue, the audience probably does not – and the message must be designed for the audience, not for the reporter. Help the journalist to interpret the meaning of the work to society.

Good information leads to good, accurate reporting. Keep the facts as uncomplicated as possible. Use plain language and simple concepts and examples. Avoid specialist jargon, especially terms that have two meanings – one to science and a different one to the community (e.g. the word 'horizon', as used by soil scientists). A useful piece of advice for both scientists and science communicators is to speak as you would if you were addressing your aunt or uncle. (This presumes your relative to be a typical member of the community, with an average education and intelligence but who is unfamiliar with the field of work being explained.)

It is vital always to bear in mind that it is not the journalist whom the scientist is addressing, but the public, in all their wisdom and ignorance, with all their prejudices, preconceptions and language difficulties. The message must be shaped so it is clear to them.

As a rule, specialist journalists are far more knowledgeable in their field. As they are usually senior reporters with wider experience, they will provide better coverage in terms of accuracy and quality of treatment. They also have more influence with the editor in achieving extensive coverage and better placement of the story. It pays to cultivate such journalists as regular, reliable contacts.

The professional science communicator needs to read the main daily papers and monitor TV and radio news and current affairs programs continually. This is because not many scientists do – some because they are focused on their work and haven't the time, and others because they don't understand or respect the media and its role in society as it has lain outside their training and professional experience. They are sometimes out of touch with issues currently regarded as important by the community or by politicians.

Familiarity with what the media sees as news is critical to effective science communication. A scientific institution that can couple its work and its achievements with the 'news' is sending a clear signal to society and decision-makers that it is in tune with events, relevant to the needs of the society, deserving of more support and greater funding. On the other hand, an institution that seeks to promote its work at a time when the news focus is strongly elsewhere risks being seen as irrelevant, out-of-touch, self-seeking or 'ivory tower'.

The understanding of what constitutes 'news' is vital in helping to structure and time important announcements. It is also essential in identifying opportunities to 'hook' the science story to running news, and so emphasise its connection to issues of current national, international and local importance.

The media should also be closely studied for reporters whose personal treatment of scientific issues suggests they have an interest in your kind of research and the skills to report it fairly. It pays to keep an eye out for up-and-coming young journalists who still have a name to win for themselves, and who may benefit from gaining exclusive access to certain science stories and so become a reliable and trusted contact of the institution.

Build and maintain a list of contacts to whom you speak regularly. Contact them at a personal level as well as a professional one, so that the relationship grows without a sense of one exploiting the other. From time to time, offer them information that is not available to other media, as there is no more convincing argument a journalist can use to their editor than, 'We've got an exclusive here'. This plays to one of the media's greatest strengths – its competitiveness. A newspaper or electronic medium with an exclusive story is strongly inclined to run it before its competitors can, and to give it prominent treatment. Once the news breaks, the competition is then strongly motivated to try to 'top' the story, to better it by developing a new 'angle' that allows it to catch up – so it is also sensible have follow-up information ready and waiting.

However, in providing exclusives, avoid being seen to play favourites among individual journalists or media, as this can antagonise the others. As a rule of thumb, 'big' stories should be released at the same time to all major media. Lesser stories in terms of news value can be released to individual media as 'exclusives', but it is wise to rotate one's favours among key media. It is also advisable to match one's science stories to the particular strengths of different media. A good medical research story, for example, is best delivered to the medium with the best health coverage or reporter. This recognises the skills of a particular media outlet and, at the same time, places competitive pressure on the others to improve their journalistic performance in that field.

Meet the reporter personally soon after you first make contact. Seek to bring him or her to the laboratory or to a field research site where you can foster an effective working relationship and build trust between journalist and scientist. This also allows the journalist to check out the 'visuals' – opportunities for photographic or television imagery that go with the story – and to size up the 'talent', the ability of the scientist to deliver the message in a way that meets the need of the medium, be it print, radio or TV. It also allows the journalist to see the scientist in context, surrounded by the tools of the trade, which can provide the 'atmosphere' that helps to create a well-rounded story.

When providing material for the media, cost/benefit figures on the research are highly desirable. How much did it cost to perform the research? Who paid? What are the estimated benefits to society or the economy of its widespread adoption? What is the size of the global or national market for this technology? How many lives could it save or benefit? What measurable difference might it make to society or to the environment?

The media dotes on dollars and cents. They are one way of translating the significance of science (and other things) into terms that ordinary people relate to. (Hence the media's eternally irritating question about priceless works of art: 'How much is it worth?') Scientists are sometime offended by the conversion of an elegant insight into the crudity of cold cash but, objectively, it is a way of helping society to value it against countless alternative activities that taxpayers are asked to fund. It should be seen not as belittling the science, but rather as a way of indicating its significance to the wider community and justifying investment in it.

In describing a scientific advance, accentuate the benefits to consumers, taxpayers, urban (or rural) society, jobs, health, export income and the nation. Even if the story is about pure (theoretical) research, its relevance can still be conveyed to a general audience by speculating how, one day, its application may change their lives or improve their standard of living.

The media is insatiable. There is always another news bulletin due, the printing press will be hungry again tomorrow and the web page must be refreshed. All journalists are continually in search of a story, either a new story or a new slant on an old story. So don't feel shy about ringing a specialist reporter at work or home, day or night, on weekends or public holidays with a tip-off or lead. In fact, they will be especially appreciative of fresh information that reaches them on a 'slow' day, such as a weekend or public holiday. These are good times to schedule media announcements.

Deadlines

Be deadline conscious. Whether they work for electronic, daily, weekly or monthly media, all journalists face unrelenting deadlines and their professional reputation stands or falls on their ability to meet these. In radio or TV news these may occur several times each day. Most media experience a major deadline late in the afternoon, and will not appreciate being informed of a new story close to it. On weekly or monthly publications, with fewer staff, deadlines are less frequent but often even more demanding and stressful for reporters than in the daily media where there is plenty of material from which to choose.

Respect for a journalist's deadline is one of the best ways to build the relationship. Failure to respect it is also a way in which communicators and scientists who have never experienced the pressures, stresses and drama of a real newsroom damage their reliability and reputation as contacts.

If a journalist seeks information and it is not immediately available, promise to get back to him or her at the earliest opportunity. This means *minutes*, not hours or days. Promptness in dealing with media requests is a critical element in the ability of a scientific institution to establish and maintain a reputation for communicativeness, cooperation and openness.

When a journalist decides to work on a story, they notify the news editor and the story is placed on the news list, along with all the other potential stories for that edition or bulletin. An expectation builds up among the editorial staff that the story will appear, fully researched and written, by the deadline or earlier. If the story does not appear through a failure of the journalist's contact to reply, the journalist is, in a subtle sense, seen to have let the team down by failing to deliver. No matter how plausible the excuse, this harms the journalist's standing with the editors in an intangible way. Several such events have the editors automatically questioning whether that particular journalist can deliver the goods.

Therefore a journalist who is let down by a particular contact or organisation soon learns not to rely on them. The journalist is likely to transfer his or her focus to other contacts, other scientists, who have shown themselves willing and able to provide information in a timely way. A reliable, deadline-conscious contact is one that journalists will use time and again. A casual or unreliable contact will soon drop off the list. While individual scientists might not care too much, in today's competitive world the bottom line may be a decrease in funding for their institution due to the loss in public profile of their work. So, in a real sense, a poor attitude to the media can have an impact on the standing of the organisation and its scientific success rate.

Institutions or scientists who ignore this fact of media life only diminish their own prospects of having their work fully, fairly and promptly reported, and hence of seeing it adopted by society.

Media releases

Releases are an effective way of communicating a scientific announcement to the media. They have the advantage of being circulated far and wide, of presenting the facts in a coherent and informative way, of providing essential details and contact points for media to follow up, and of being checked and cleared by all concerned. They put your version of the story 'on the record'.

A good science media release consists of:

- an eye-catching headline designed to appeal to journalists (*not* to scientists or corporate egos);
- an opening paragraph stating the significance of the announcement to the general public or a target audience (e.g. an industry or policy-makers);
- details of who is making the announcement, with correct titles and honorifics;
- text written in news style, with one sentence to a paragraph, one idea to a sentence, and the most important information at the top;
- lively quotations attributed to the lead spokesperson to give media a sense of the colour and importance of the story;
- recognition of all relevant partners and collaborators in the work. Note that this should go lower in the media release. No matter how important these institutions may think they are, their names (usually, alas, long and cumbersome) are of secondary significance to the media;
- clear statements of the importance of the work to the economy, jobs, society, ordinary people, industry, government policy, particular regions or localities, or the world;

- a simple explanation of how the science was done and how it works (a diagram or graphic can help here);
- contact details for spokespeople at work and after hours, and for a communicator who can locate them within minutes if need be, along with email and web addresses;
- details of picture or vision opportunities for TV and news photographers; and
- a web address for other still pictures (in jpg or other format), sound or vision that the media can download.

News desks and journalists are engulfed in a daily avalanche of paper and electronic information. Scores and often hundreds of announcements must be evaluated for newsworthiness and priority in a short time and reporting resources allocated. Most of these announcements receive barely half-a-second's scrutiny from a fast-reading editor, chief-of staff or news reporter on their way to the waste bin. A strong, eye-catching headline combined with a powerful, crisp and relevant opening will save yours from such a fate.

'PR' releases written to aggrandise the institution or to please a purely internal audience have a poor rate of success compared with those deliberately crafted to appeal to media, so make your releases snappy, concise, newsy and factual. Make sure the news is in the headline and the first paragraph. Purge it of all jargon. Don't bury the main point or it may be overlooked.

Ernest Hemingway trained as a journalist on the *Kansas City Star*, and always recalled the injunction in its style book:

> *Use short sentences. Use short paragraphs. Use vigorous English, not forgetting to strive for smoothness. Be positive, not negative.*

The *Star*'s exhortation applies equally to the well-crafted science media release (and is in some respects the antithesis of traditional scientific prosody). To this is added the necessity to avoid clichés, tautologies, ambiguities and specialist terminology, bureaucratic language or 'technospeak'.

Here is a checklist of things to consider in issuing a media release:

1. Does the text answer the six key journalistic questions: Who? What? When? Where? How? Why?
2. Who checks it? Did all the partners see it? Who gives final clearance for it to go out?
3. Which media should be targeted for optimum impact?

4. Should it be distributed locally, nationally or internationally?
5. What is the best mode of delivery: email, fax, post, web or conference?
6. What picture, vision or sound opportunities must be planned?
7. What graphics must be prepared in advance?
8. Is the spokesperson freely available for a day or more after the release is issued? (Some scientists have a curious habit of issuing a release and then disappearing.)
9. Can they be easily reached out of office and after hours?
10. Is the release 'stand alone', or can it be 'hooked' to major topics now running in the news, thus increasing its prospect of coverage?
11. Which key journalists should be notified in advance that a release is planned to ensure they receive it?
12. If the topic is controversial, have the relevant stakeholders and partners been fully briefed?
13. Is there a follow-up story? Is it better to plan a series of releases to build awareness rather than a single 'fire-and-forget' announcement?

Embargoes

If you don't want your announcement published at once, but to await a special time or event such as a press conference or public ceremony, then put an embargo on the release requesting the media not to publish the content until a specified date and hour. Most news media will respect this, although it is wise not to expect too much of a highly competitive industry in the case of a really big story.

Put prominently on the first page the words 'Embargoed Until', followed by the desired date and time of release. Check carefully the deadline times of your target media so as not to select an inconvenient time or, worse, one that falls after their deadline has passed. Avoid, wherever possible, setting an embargo time that favours one media outlet or medium over another, as this can anger the loser. An embargo may be for several hours or several days ahead of the release time.

This technique is especially useful for releasing substantial material to background important announcements, and most journalists will be highly appreciative of the extra time it gives them to assess the information, work on it, arrange for vision, interviews, graphic art and so on. The result is more accurate and fuller coverage than would normally be the case.

Target media

Careful thought should always be given to targeting media announcements. Many releases are wasted because they are poorly designed for the particular needs of the media they are hitting, and only serve to annoy the journalists who have to sort and discard them.

Different media require different kinds of stories or different treatments of the same story ('angle'). Sometimes it pays to make several slightly different releases on the same topic, each one tuned to the needs of a distinct media group.

Examples of media categories requiring different treatment include:

- national daily press and electronic media;
- business and company newspapers, magazines and sections;
- feature sections in major papers;
- current affairs programs on the electronic media;
- specialist publications for business and industry;
- computer and IT publications and sections;
- medical and health publications and programs;
- food, diet, nutrition and cooking media;
- lifestyle media;
- sporting media or sports sections;
- rural and farming publications;
- regional and local media;
- women's, family and general interest magazines; and
- radio and TV chat shows.

A well-crafted general release may meet the needs of all the main target groups, but one that is precisely targeted at a particular part of the media will, on the whole, enjoy fuller coverage and be more effective. A sensible approach is to develop a general release and then rewrite just the headline and leading paragraphs to appeal to different media categories. A technology story, for instance, can be presented in terms of its overall significance to society for general media ('New drug to save lives'), its financial importance for business media ('New drug boosts corporate earnings') and its parochial significance for local media ('New drug brings jobs to Smithville').

Another way to do this is to plan a series of announcements over several days, weeks or even months, each time targeting a different media category or else presenting a fresh angle on the same story. Science shuns repetition of the same old data or theory, but it is absolutely essential in public awareness. The art lies in telling the same story many times, but always with a novel and distinctive twist and at an advantageous time. At one moment the focus may be on the scientific advance, next on its significance to humanity, then in its commercial consequences, then on the people who achieved it, and so on. Modern knowledge management theory contends that the 'story' is in fact an ideal way to share knowledge. Homer understood this 2700 years ago, journalists have known it for at least three centuries, and now giant technology corporations like IBM are also discovering that stories can be used to enable informal knowledge transfer.[2] It is a fact that most people prefer to hear stories about science than having to digest plain, unadorned data and excruciating prose.

To reach different media audiences with precision and impact requires a list of media contacts sorted into different audience categories, and an effective electronic distribution system. This will usually consist of a compilation of email addresses and fax numbers for key media organisations and individual journalists. Public relations companies, telecommunication firms and media organisations all provide commercial media release distribution services but usually lack the precision targeting, timeliness and cost-effectiveness necessary for an optimum result. Although laborious, it is far better (and cheaper in the long run) to assemble one's own unique media contacts list and maintain it so that it is always up to date. Media directories can be purchased for most countries and even for the world, although they too are often out of date. Nevertheless they provide a starting point for assembling a media contacts database that can then be supplemented by direct calls to the media itself.

The most effective way to use such a database is to plan every release in terms of its individual target audience(s) rather than merely broadcasting it and risk causing irritation to receivers who do not want it. The release can be sent to particular categories of media and journalists (e.g. farming media, health media, science reporters, environment reporters) or even to individuals within each category. Because media tend to have a strong local focus, it is very useful to be able to target a story at a particular region, city or locality affected by it.

It is sensible to send copies of the same release not only to the key journalist, but also to their chief-of-staff or news desk. This ensures the editors are aware of the story, even if the journalist is away. It helps to place it in the news system.

Some stories lend themselves to targeting news media, while others suit the more relaxed setting of radio or TV talk shows, feature sections and magazines. It is valuable to be able to distinguish between the different categories. As a rule, a news story contains material that is new to the media and has never been published in quite that form, whereas feature material focuses more on the wider context, in-depth treatment or human interest aspects.

Media conferences

A media conference is an event that takes place at a set place and time for the purpose of making a general announcement to a wide range of media, or to a specific group of journalists (e.g. science, medicine or environment reporters).

These are a good way to make important announcements, but beware: they can backfire if not well-managed or if the subject is not sufficiently significant in the eyes of the media. As a rule, a media conference should *only* be called if the topic is of major importance to the external world. It is not something to be staged on a corporate whim, but should be used sparingly and with professional judgement.

Failure to observe this fundamental rule can result in a spectacular disaster if the media become sufficiently frustrated and annoyed. They, after all, make a major investment of staff, time, equipment and money to attend, in the expectation that they will obtain a strong and newsworthy story. If the conference fails to live up to their expectations or to meet their needs, at the least the journalists and their managers will be reluctant to devote time or resources to covering future events by the offending institution. At worst, they may become aggressive.

The following are some basic rules for organising a successful media conference.

1. Ensure there is a genuine news story to be announced with strong local, national or global significance. If in doubt, take professional advice from a friendly working journalist.
2. Field your best spokespeople at the conference, ensuring they are briefed well beforehand and are confident performers for TV and radio as well as print.
3. Time your conference carefully to allow all the target media adequate time to digest, report and analyse your announcement before their deadline. As a rule, a morning conference is preferable to one held in the afternoon or evening.
4. Issue an alert or invitation, both to key journalists and to their news desk several days ahead of the event, to ensure your conference is in their news diary. Try to avoid a clash with other major media events.

5. Provide a detailed media release or background kit to all journalists who attend, and to others who may not be able to come. Make sure it contains all relevant facts in plain language, as well as pictorial and graphic illustrations the media can use to clarify the subject to their audience.
6. Keep opening statements short and to the point. Don't waste time duplicating information that is already in the kit, but focus on the key announcements.
7. Plan the 'punchline' to the conference well in advance. This point will be made, in different ways, by the various spokespeople taking part. Allocate other key points among the speakers.
8. Provide spokespeople from partner institutions, industry or government to confirm the value of what is being announced.
9. Provide picture and film opportunities for TV and print photographers including, where possible, attractive imagery such as intriguing scientific equipment (NOT computers), research settings involving animals, people or plants, and picturesque locations.
10. Rehearse your spokespeople ahead of time and train them not to use technical jargon and not to say 'no comment'.
11. Provide time and a place for one-on-one interviews with the key spokespeople for individual journalists afterwards. Remember that each journalist may want to obtain a degree of exclusivity in what they report.

Ensure your spokespeople are freely available to journalists for follow-up interviews after the press conference, as they may wish to check facts prior to their deadline. Provide working and after-hours contacts.

Interviews

If a scientist has been asked for an interview by a paper, a TV or radio program, he or she needs to take the time and trouble to prepare responses, develop background information and identify the two or three salient points to be made during the interview. The communicator's help can be critical in this process to add an external perspective on how the interview will appear, as distinct from an internal or organisational perspective.

The typical commercial TV news story is 40–80 seconds in length. Radio is even shorter and a print news story is about 250–500 words. This means the 'live quotes' from the scientist will only take up about 8–15 seconds of the electronic story or two or three paragraphs of the print version. Asking scientists to sum up their life's work in ten seconds is quite a challenge. If

apoplexy can be avoided, then the focus of the interview has to be on that single crisp, concise and colourful sentence that explains for the audience *what the science means to them.* Such sentences seldom fall from the tongue on the spur of the moment. They usually have to be crafted, worked and re-worked, with exquisite care. Then they have to be rehearsed. Finally, they have to be repeated during the interview, sometimes several times, to give the media a choice of useable quotes.

This is all rather a nuisance to the busy researcher, and it may be necessary to note that organisational reputation and funding is what's at stake, as well as the ultimate successful adoption of the research in question. A good communicator can do a lot to make this process less painful and time-consuming for the scientist. Like riding a bike, after a time it comes naturally to most people.

Radio offers one of the friendliest ways to accustom researchers to meeting the needs of the media, especially those mid-morning, mid-afternoon or evening guest interview shows that tolerate a bit of rambling and have time to delve into how the science was done. Here the interview may last for 5, 10 or even 15 minutes, and eases the scientist gently into the process of shaping and editing their story for the media. They soon learn, from the reaction of the interviewer, where the interest lies, and what is considered 'boring' to the radio audience. They learn, too, that as human beings their feelings and personality are just as fascinating as their discoveries. Many a scientist has been stumped when describing their great breakthrough by the simple question, 'Yes, but what exactly did you *feel* when you made this discovery?' At heart, the media wants every discovery to be heralded by the naked elation of a 'eureka'.

As part of the preparation it is important to ask beforehand:

- exactly what is the interview going to be about? (i.e. is it really within the interviewee's expertise);
- how many minutes or seconds it will be on air? (this gives a good idea how to martial the argument and whether there is time to make more than a single key point); and
- Who else is the interviewer speaking to on the topic? (this indicates whether they are trying to set up a controversy or debate and whether it is about the actual science or something else).

It is sound practice for the interviewee to jot down the key points on a card to make sure they are all covered in the time allotted. As experience grows, the skilled interviewee learns how to turn almost any question back to the topic they wish to pursue.

In handling a controversial issue it is important for the communicator to carefully select the spokesperson on the basis of experience, presence of mind and clarity of delivery. At the same time, put forward spokespeople from other organisations who can support your claims or statements. This saves the media time hunting around for corroborative evidence and reinforces your own story. It also provides them with variety and 'balance' in the form of a wider range of people to quote.

On and off the record

When speaking with a journalist, be conscious that you are addressing the public, however private you imagine your confidences to be. Under the journalists' ethical code, a reporter is technically obliged to caution you if you are 'on the record' (being reported), but in practice this is usually assumed by both parties.

So you need to spell out exactly whether what you are saying is intended to be reported, (i.e. ON the record) or purely as background (i.e. OFF the record). Always feel free to ask: 'Am I being quoted?' If the journalist replies affirmatively, then ask to have your quotes read back to you, so you can clarify anything you may inadvertently have told them in the innocent belief that you were 'just chatting' or off the record. If giving an electronic interview, remember that one of the oldest tricks in the book is for the tape to be left running after the interview has apparently ended, while the journalist broaches the controversial issue apparently out of an innocent personal interest.

In dealing with a sensitive issue, in which you may wish to make remarks about other individuals or bodies that you wouldn't quite like to see associated with your name in cold print, the best tactic is to say: 'First I'd like to give you the background, which is off the record… afterward I'll give you some directly attributable quotes'. Then make sure you distinguish the point when you move from unattributable to attributable quotes.

Never tell a journalist: 'You can't report this'. If it's good news copy or in the public interest, journalists can report anything they wish. If you don't want something reported, then don't tell the media in the first place.

These points all underline the importance of building a relationship of trust between journalist and scientist or science communicator, where each comes to rely on the integrity of the other and there is cooperation rather than a fear of exploitation.

Effective communicators often use the media by providing background briefing to their trusted contacts, who can then write accurate stories based on 'informed sources'. This is a good way to raise issues that governments, bureaucracies or other elites don't want exposed but that need to be aired in the wider public interest.

Troubleshooting

Politeness and courtesy are also keys to developing good relations with the media, even if a reporter annoys you through ignorance, persistence, or having got something wrong. The thing to remember is that it's not the reporter you're serving, it's your science. It will repay you to get the message over patiently, clearly and politely.

Never use the phrase 'No comment'. It's like taking the US 5th Amendment, and makes any journalist smell a rat. Answer every question possible, but if you have to duck one, then explain carefully your reasons for doing so (e.g. 'I can't answer that because it is covered by a legal confidentiality clause, but I can give you a general idea what the work is about'). People who say 'No comment' are regarded by the media as arrogant and dismissive of the public interest. They will soon find themselves under uncomfortably close scrutiny.

When misreported, the immediate instinct is to get on the phone and rebuke the journalist. Don't do it. Have a cup of coffee, calm down, then come back and ring to see if you can turn the mistake into extra coverage by persuading them to do a follow-up report that clarifies the situation.

The reason for this is that it may not be the journalist's error in the first place – and you will never know it. The mistake could have been make by another journalist whose copy was incorporated into the same story, by the copy sub-editor, the page sub-editor, the news editor, the chief of staff, the editor, or any one of a dozen different journalists who handled the writer's story after it was filed. Blaming the journalist will only antagonise him or her.

Above all, don't blame the journalist for the headline, which was almost certainly written by a sub-editor and is designed to attract reader attention – not to summarise the content of the story.

The mistake may also lie with the scientist, who perhaps didn't take enough care to explain the story in the first place. Besides giving an interview, did the scientist also provide a simple plain-language document explaining the work? This may seem like a chore, but often an existing document like the overview from a grant application or the abstract from a scientific paper will help. Better still, write a simple summary of the work and its meaning and make sure the journalist leaves with it in hand. When they are back at the office and find something in their notes they can't understand, a glance at the summary may clarify it. It will also correct spelling. It should provide contact phone numbers for the scientist, not just in the office but also on mobile and after hours, because the journalist may still be at their desk filing copy long after the scientist's working day has ended.

Some scientists ask to view the finished copy to ensure accuracy. This is a step that must be taken with extreme care, and only by a scientist with some experience in dealing with the media. The reason is that it infringes a basic journalistic principle of impartial, objective reporting free from external influence. The scientist's intent may simply be to ensure scientific precision, but for the inexperienced the temptation will be to tinker with how the journalist reports the story – and that can rapidly lead to a fight. As a rule, a scientist may offer to vet the story and their direct quotes for scientific accuracy alone. They cannot insist. They do not own the story, even though it is about their work, and the journalist is under no obligation to show it to them. Good journalists, in our experience, do not usually object to someone helping them to 'get it right', but they strongly resent any attempt to change the way they are reporting it, or any delay that may cause them to miss deadline. The journalist knows far better than the scientist what the editor requires and what their outlet will publish or broadcast. With the best of intentions, the scientist may so distort the news value of the story as to make it not worth running. Then everyone has wasted their time and the journalist is unlikely ever to return.

One reason for such misunderstandings is the contrasting publication traditions of researchers and journalists. News reporters concentrate the significance of their story for their audience in the first paragraph, the 'lead', then support the initial claim in the paragraphs that follow. Scientists, on the other hand, prefer to build their argument on a bedrock of methodology, data and prior research before drawing a conclusion. Some researchers seem to obtain an obscure delight in concealing their conclusions in paragraph 89, thus making the reader work all through the argument to reach it. Media style is based on newspaper practice, which allows the reader to browse the headlines and lead paragraphs in search of the information they desire. The impact of the story on the reader comes in the first few paragraphs. The 'lead' is designed to sell the story to the reader, to catch their eye and make them want to read it. The writing styles of scientist and journalist are thus almost mirror opposites of one another. A scientist who seeks to impose scientific style on a news story will usually succeed in killing it stone dead.

What not to do…

As a matter of good practice in dealing with the media, don't:

- demand retractions;
- make empty threats;
- run to the lawyers to issue writs;
- abuse people who may be quite innocent;
- complain to a journalist's editor unless you are sure they are guilty of a breach of professional standards; or
- write abusive or hysterical letters that will only make you look foolish.

All of these can irritate the media, and it can make a bitter (and unnecessary) antagonist with a memory like an elephant and a capacity to harm or ridicule your organisation over time out of all proportion to your ability to strike back. In the case of a misreport, a cool head is essential. It is best to try to amend the situation by generating a follow-up story either in the offending medium or else its competitors.

A considered response to a misreport involves careful analysis of who actually saw the report and who believed it. The impact of a misreport cannot, and must not, be judged by 'common-room indignation level' or the ire of senior management. The science communicator often has to spend a fair amount of time hosing down internal outrage before planning a measured response. The correct strategy is to work out which audiences saw the report, whether or not they believed it and, if so, how to deliver an accurate version to them with precision. In devising a plan, it is important not to draw the dispute to the attention of a much wider audience. The response, in other words, should be proportionate.

Many institutions manage to shoot themselves in the foot by over-reacting to a minor report on the inside pages of the paper and either attacking the media or seeking an unnecessarily prominent correction. The effect of this, often enough, is to turn the science organisation's purple-faced outrage into the subject of the next story – and to advertise its thin skin to the rest of the media as an open invitation to journalistic mischief. In many cases, wisdom will decree it is better simply to write the error off, provided it has not been shown to cause material harm to the scientific and public standing of the organisation. It'll probably be forgotten by tomorrow in the hectic news world.

If, however, it is judged that key audiences and the public have been misled and there is need for a correction, a measured, temperate letter to the editor stating the facts is one way to set the record straight. A press release can work, but may on occasion serve to escalate the dispute because it will engage the offending media's competition. Press conferences should only be called in the most serious cases of misrepresentation, and the response strategy very carefully thought-out. The law is the last resort of all, if only because a writ represents a declaration of war and the law is not, in any case, the best forum for resolving scientific disputes. The guiding principle in all such disagreements should be the public interest, as distinct from organisational outrage.

Scientists fear a media misreport because of the effect they perceive it may have on their science, their standing with their colleagues and their career. However, experience shows the risks are much lower than their imagination may depict.

In one scientific institution, scientists who had never had a media experience were asked how it would go: 85 per cent were sure they would be misreported and made to look foolish. When scientists who frequently took advantage of the media were asked the same question, 85 per cent said the experience was usually either satisfactory or directly beneficial to their work. The one-story-in-six that went wrong was regarded as the price of doing business, and seldom an irretrievable negative.

If a genuinely prejudiced and hostile journalist shoves a toe in the door and demands answers, it is important to respond with courtesy and polite promises to get back as soon as you have verified the situation. It appears far better on TV than a guilty-looking figure scurrying into the lab for safety.

Why your story didn't get in…

Don't blame the journalist if your story failed to make it into the newspaper or electronic bulletin, or if it is cut very short. It is almost certainly not his or her fault.

On a big newspaper there may be 50–100 writers, each filing one or more stories and comment pieces every day, plus scores more coming in from contributors or news services. Out of this pool of 200 or 300 possible stories the editors choose the 25–35 stories they think are most worthy of a run. The other 80 per cent end up 'on the spike' (discarded). The pressure and the competition for newspaper and news bulletin space are enormous.

If you story didn't get in it is probably because, stacked against the news of the day, it didn't rate strongly enough in the opinion of the editors, no matter how important you thought it. Remember, it is seldom competing against other science news but against general news about politics, the economy, world developments, unemployment, business, crime, sport, the arts and so on.

This is why a science news story must be as hard, vital and as relevant to the audience as possible. Its release should be timed for a day when general news-flow may be down or there is a running news story connected to the same issue. A day when there is a major national disaster, scandal or news event to fill the headlines or when parliament is in session and there is lots of political news is less favourable for a science story.

If your story fails to get in, try to find out why and analyse the reasons. Some of them may be within your power to influence, and you can arrange things better next time. One major reason a science story fails to make it is that it is 'boring'. This does not mean it lacks intrinsic interest, but that it has no obvious relevance, immediacy, colour or human interest to connect it to the media's audience. Mostly, this means not enough time was spent considering how the media would respond to it, or how to engage the public's interest.

As novelist Terry Pratchett remarked: 'the public interest and what the public are interested in are seldom the same thing'.[3]

Media releases particularly misfire when the institution is more concerned with trying to preen and burnish its 'image' than it is with the true meaning of its work to society. The media has plenty of time for the latter but a limited tolerance of the former. Stories perceived as having more to do with corporate ego or self-justification are, rightly, considered boring.

Media skilling

A scientific organisation that is serious about sharing its knowledge, building its profile and attracting research funding will ensure media training for key spokespeople. These include not only senior managers and directors, but also the leaders and deputy leaders of scientific research programs and, in some cases, much younger scientists who are seen as having the right skills for media work – particularly if the organisation wishes to project a youthful, vibrant or female image to offset the 'boffin' stereotype.

Good media training usually involves exposing the researcher to real working journalists from the different media in a lifelike interview situation. Replaying the tapes and having the journalist explain where the scientist 'went wrong' is very instructive. However, it is important during the training not to pitch it at too threatening a level as the aim is to build confidence, not to undermine it.

Working journalists can be a great help in identifying who is, and isn't, good media 'talent'. One of the critical jobs of the communicator is to know whom to keep right away from the media – the rude, the abrasive, the arrogant or dogmatic, the impatient or those who simply do not understand the function of media in modern society and its role in a democracy. Being a brilliant scientist does not always equip a person for the role of science communicator.

Media training usually takes place at three levels:

- introductory, to help the scientist understand the needs of the different media, how to satisfy them and how best to put their work across;
- medium, for senior researchers and research leaders who have had some media experience but are now starting to find their work in the public spotlight or subject to growing controversy. This provides a higher level of skill and confidence in dealing with difficult questions; and
- advanced, for chief executives, directors of research, deans, vice-chancellors and others who may find themselves subject to aggressive media questioning in a crisis situation where responses need to be handled with tact, consistency and skill.

Very few scientific organisations invest in a regular program of media training for their staff. This is a serious oversight in a media age. Those that do are the ones that recognise that effective sharing of knowledge requires understanding to be developed on both sides, not just on the part of the public and media.

Public figures

Well-known public figures can help to promulgate the outcomes of research. If the story itself is complex or a bit dry in media terms, it can be enlivened by having a prominent or colourful identity linked with it. Politicians, industry leaders, actors, media personalities and sporting heroes can all be used in this role. It works best if they have a personal connection to or interest in the research.

While many scientists recoil at the mere thought of having a rock star help publicise their work, the media and general public will be fascinated to know why the icon is interested in being involved. Princess Diana's global promotion of awareness of the land mine issue is an example of the effectiveness of this technique for knowledge sharing.

Qualities that celebrities can bring to science awareness include:

- greatly enhanced photographic, TV or interview potential for the media;
- the 'curiosity factor' of why the celebrity is involved;
- public endorsement of the importance of the work;
- the representation of the work in terms that ordinary people can more readily relate to by virtue of the celebrity's involvement; and
- improved scope for fundraising or investment in R&D.

The *Future Harvest* campaign designed to promote awareness of the importance of agricultural research employed figures ranging from Jimmy Carter, Mohammed Yunus, MS Swaminathan and Queen Noor of Jordan to rock group Hootie and the Blowfish as its international ambassadors (see Chapter 7). The ambassador technique is extremely effective for conveying to governments, private investors and the public the importance that respected and well-known figures place upon a particular field of science.

Controversy

Many researchers, especially older ones, shy away from public controversy. As a result, their science receives a lower external profile and their advice is sought less often.

Controversy is something to be used to advantage in knowledge sharing, rather than feared, although it must be done with skill, careful planning and some effort to anticipate the possible consequences.

A scientific organisation keen to demonstrate the value and relevance of its work and share its knowledge must be prepared at any moment to engage in national or global debate on sensitive issues. Too many institutions content themselves with merely issuing statements on matters *they* regard as important, while ignoring the opportunity to participate in the larger public debates that occupy the headlines.

If a scientific body wishes to raise the profile of its scientific work and share it more effectively, its leaders and communicators should scour the media daily for issues on which they can comment expertly, interestingly and with originality.

Don't wait for the media to come to you. Go out and look for them.

Libel

Unless you clearly understand the laws of defamation in your state and country, be careful about making any statement that may bring an individual or company into public contempt, injure their reputation or cost them financially. Remember that the institution and its staff can be sued, as well as the media that published the claim.

In modern law, mere truthfulness is not a completely reliable defence against a charge of libel. One more likely to be supported by the courts is that the statement was made in the public interest.

When in doubt take legal advice. The media has its own libel experts and these can usually be relied upon to provide helpful comment on what can and cannot be published with safety.

The libel that costs the most is the one you least expect. It is the casual remark, the unverified fact or the momentary loss of caution that leads to the writ that is hardest to defend. Science and academia are particularly vulnerable because the kind of *ad hominem* remarks that may be directed at colleagues in vigorous seminar or common-room debate take on an entirely different complexion when made in front of the media.

Radio science

The SciFiles, developed by Nick Goldie of CSIRO, is an excellent example of low-cost yet highly effective use of radio for raising awareness about science and technology.

This monthly program contains 20 short stories, about 2–4 minutes in length, pre-recorded onto a CD and then distributed to 250 of Australia's radio stations for free-to-air broadcast. It is accompanied by a brief description of each story and contact numbers for the interviewees, so radio presenters can do their own interviews if they prefer. It thus serves a dual purpose as a pre-packaged program and an electronic media release.

The stories focus on the people who do research, their experiences and views, rather than on hard news. They are designed for broadcast in the mid-morning, afternoon and evening segments and for easy listening. The program format and delivery method was developed after surveying the needs and preferences of radio station producers and presenters. Regular research is carried out to ensure it continues to meet those needs. The program could also be delivered by web, by landline or on cassette, depending on demand from users.

The series is designed to raise awareness of science, not to promote any particular organisation. For this reason it also features the work of other institutions besides CSIRO.

The SciFiles is broadcast on the Australian national broadcaster, the ABC, on commercial channels, public access radio, FM and AM, and is used by about 70 per cent of all radio stations, giving it the widest exposure of any single radio program in Australia. Cost of production is about A$100,000 per year.

The program has also proved valuable as a way to identify fresh media talent among scientists, and to provide them with some basic media experience and training.

Television science

Australia's CSIRO also pioneered a series of short science stories for national and international television. Within Australia this is known as *Australia Advances*, while overseas it is called *The SciFiles*.

Six short, lively science stories are distributed quarterly on betacam tape to all TV networks in Australia, including the main commercial channels and cable TV for free-to-air broadcast. They are also distributed internationally and are available on the web.

The stories are in two formats – a short version of 90–180 seconds (similar in duration to TV news items and advertisements) and a longer version of 5–7 minutes (designed for use in magazine programs). These formats were selected after consultation with senior TV producers.

The stories are used in different ways by different TV channels – as news items, as feature items, as 'fillers', as community service items and as electronic media releases that the TV station re-edits to create its own version of the story. The tape provides media editors with science footage that they can use free of charge.

A major advantage of this program is that the same stories appear on different TV channels at different times, and that many of them are broadcast repeatedly for periods up to 18 months, resulting in multiple exposure to a wide range of audiences.

Care is taken to present the stories in a strictly journalistic style, as objective reports, and to avoid any hint of publicity-seeking by the research institution. Any Australian research institution can participate for the cost of production.

Within Australia the series received 400 screenings a month, reaching a regular audience of about five million. Calculated at the lowest TV advertising rate available in Australia, this equated to $3 million in free publicity per year. It is thus an exceptionally low-cost vehicle for the delivery of scientific information and knowledge to the wider community when compared with paid advertising or the regular production of a TV science program with a limited audience. In addition, the series has been screening internationally in places such as China, Europe and South-East Asia.

Both transcripts and video versions of the stories can be downloaded from the web and can be used, for example, by science teachers to enliven their classes with video of actual scientific achievements. They can be found at:
http://www.csiro.au/promos/ozadvances/

Both the radio and TV series were developed in response to the findings of market research that young people today are more likely to obtain their information from the electronic media than from newspapers or magazines.

Chapter 4

Communicating with government

If scientists and journalists make an odd couple, then scientists and politicians seem a decidedly ill-assorted match. Nevertheless, they too are essential partners in the process of knowledge sharing.

Most scientific institutions depend, to a greater or lesser degree, on public support from governments and legislators, either as direct funding or through incentives that encourage private sector or philanthropic investment. They also depend on governments to incorporate the findings of scientific research into public policy for the benefit of the whole community. At a pragmatic level, about three-quarters of all new patents lodged worldwide began life in a publicly funded research institution, even though they may have passed into private ownership subsequently.

In the face of these facts, one would expect the relationship between scientific institutions and the world of politics and government to be extremely close, if not intimate. It is therefore a surprise to find that many scientific institutions have limited skills when it comes to understanding and dealing with governments, and with politicians in particular and, despite its importance, they devote relatively few resources and scant effort to furthering the relationship. Where they do make attempts to influence the political process, their efforts are frequently naïve, unsophisticated and fragmented, at least when contrasted with those of industry bodies, professional lobbyists, interest groups and the like.

As funders and users of science, ministers, members of parliament and the senior public servants who advise them are among a research organisation's most important customers and stakeholders, yet the effort invested in relating to them seldom matches, for example, the effort put into working with industry to commercialise research outcomes. This chapter looks at the cultural differences between politics and science, and explores ways the institution can service its political customer base more effectively and play a more influential role in the formation of national policy.

What MPs think about science

It is sometimes a shock to scientists to discover that science is a low-order issue in the cut-and-thrust of national or local politics. It rarely provides the substance for major political debates and, on the occasions when it does, is quite often resented by politicians for having intruded unexpectedly into their world. *The key to an effective partnership between science and politics is for scientists and their managers to develop a better insight into the way the political mind and process works, and then deliver their research findings according to its needs.* In dealing with politics, a 'science of service' attitude works rather better than the traditional 'we're here to tell you the facts' approach.

'Politicians think political priorities,' says science adviser Marie Keir, who has worked on both sides of the ministerial fence. 'For backbenchers, electoral issues come first, then major party policies. This is why science rates low behind job losses, property issues and things that affect local voters. But if a local issue can be solved by science, then science becomes a political priority'.[1]

Politicians of all parties and backgrounds generally understand the need for research, and very few politicians are actively anti-science.[2] In surveys, most Members of Parliament usually say they rate science as either important or very important. Statements such as this, however, are akin to endorsing motherhood and do not convert automatically into increased support for research and development, or the assured inclusion of scientific findings in policy.

When it comes to funding, science often appears to the MP as one in a long queue of worthy causes demanding greater resources. The scientist pleading for increased resources often forgets (or is perhaps completely unaware) that he or she is part of an unending queue of supplicants with similarly deserving causes who knocked at the Minister or MP's door that week, or even that day. In the pleas of their advocates, all these causes are urgent, all are vital to society, all are in the national interest, all affect the peace of the realm or the health of the community, all have social and political benefits such as higher employment, greater income or environmental sustainability, and many cater to the marginal electorate. The real issue is how the politician reaches an intuitive decision about which ones to back, to what extent, and which ones he or she can afford to ignore.

Politicians have differing views about the adequacy of scientific research funding. In one Australian survey 52 per cent of Federal and State MPs considered that science was inadequately funded, whereas 48 per cent either had no opinion or thought it to be funded sufficiently. This was in a context in which the objective evidence pointed to a real decline in national science investment. One-third of the MPs admitted they had never actually considered the question of whether science received adequate support. While the figures may vary from country to country, it is likely there exists in all legislatures a proportion of representatives for whom science is not even on their political radar, or close to it.

Another intriguing revelation is that not all legislators see a connection between science and technology funding and economic outcomes, as the following quotation from an Australian MP illustrates:

> *Science and technology are important. But scientists also need to understand that economic prosperity and defence probably rank higher.*[3]

This MP clearly regards science expenditure as a budget drain, not as an investment in the future or an input to the economy, and technological supremacy as having little to do with defence. Such is democracy. Despite the apparent lack of logic in his position, there is in fact a (reasonably) sound political basis for it – although it is one most scientists would find hard to appreciate. Any science this MP funds today is unlikely to have a significant payoff in his political lifetime, or to help him be returned to office in the next election a year or so away, whereas a handout or tax cut can have immediate political results. The scientist may bemoan such a short-term view, but it is as much a reality in political life as the law of gravity is in physics.

Budget priorities

In tight fiscal times, increased public support for science must generally be found through cuts elsewhere in the budget – a practical fact that science lobbyists tend to forget or ignore. While making a good case for extra funding for research, they omit to offer practical suggestions about where the money might come from. This conveys to politicians an impression that scientists imagine that money grows on trees.

For the MP, the issue is how and when to trade off perceived political pain against political gain – what will be the cost in disaffected voters from the cuts to, say, defence, education or social welfare, as contrasted with the increased electoral support likely to flow from enhanced funding for research. This explains why medical researchers often do better in the budget stakes than their colleagues in other fields of science – lives saved are a potent and highly visible political justification, whereas the benefits of a better grasp of chaos theory are a bit harder to explain to the electorate.

This does not make it impossible to mount a case for enhanced funding of theoretical and blue-sky science. However, it does mean that the research organisations seeking it need to be smarter and more imaginative in how they go about it. In some cases they can link their work to clear national goals and political priorities. In others the mere promise of a expensive equipment – a synchrotron or radio telescope, for example – will do the trick because of the kudos it brings to the local community and its elected representative.

However, an important key is providing MPs with detailed cost/benefit and social/benefit analyses of the work in question, allowing them to exercise their political judgement about its relevance and importance and its political 'saleability' to the electorate. They also need readily accessible examples of the benefits or outcomes of the work that they can transmit to electors or put forward in the course of debate over political priorities.

A slightly different approach is needed in dealing with the bureaucracy, where science proposals come under the chilly scrutiny of treasury and finance department officials. Here the key measure is return on public investment rather than political instinct or public opinion. Keir[4] argues that case studies showing how much the nation, or industry, actually gains from certain research are far more persuasive than heartfelt appeals such as 'we *must* have a scientifically literate population' or 'we *must* keep up or risk being left behind'.

The most influential advisers, she says, are usually those at senior executive level of the public service. These are the people asked to comment on submissions for science funding, and their attitude towards the applicant may be of great importance.

Competitive funding ranks high with bureaucrats because it seems to them to imply financial rigour and efficiency (which is not always true, alas, given the paperwork involved). It also puts some distance between them and responsibility for actual decisions. Proposals that mesh with key national priorities and goals are also likely to win bureaucratic approval as well as political support.

Lack of contact

One of the most damning remarks made of modern science is the occasionally voiced complaint of politicians:

> *The only time I ever see a scientist is when they want money.*

An Australian survey found that only 18 per cent of Federal and State MPs regarded the interaction between scientists and politicians as 'successful'. The rest considered it to be neutral (42%) or unsuccessful (40%). If only one MP in five is happy with what they are getting from science, then science clearly has a lot of political homework to do.

The reasons given by the MPs for their dissatisfaction include:

- lack of cost/benefit data on the science;
- lack of face-to-face engagement;
- scientists' belief that government should fund most research; and
- inadequate communication of scientific issues through the media.

One-third of MPs said they never met a scientist during a typical year, while a further 38 per cent said they received some form of scientific briefing only once or twice a year. This indicated that 71 per cent, or nearly three-quarters, of Australian Federal and State MPs had little or no direct contact with either science or scientists.[5] The same is true in most countries.

This may seem bad enough for science, but there is an even more alarming aspect: at any one time – to use the Australian Parliament as a case study – this cohort of science-deprived MPs will include four and possibly six future Prime Ministers and more than 100 future Ministers, who will thus have little exposure to science and knowledge sharing in the course of their political careers, but who will come to wield enormous influence over it. They will be called on to assess the outcomes of scientific research for relevance to public policy, and to rate them against less rational claims for their political practicality.

As might be expected, those MPs who never or rarely contact science also hold the lowest opinions of its importance, its funding inadequacy, its policy usefulness and its success in meeting politicians' needs. A good many of these politicians belong to the numberless class in the community who were 'put off science at school', regarding it as arid, dull and the province of nerds. It is distressing, but not hard, to see how the prejudices of adolescence may be reflected in national outlook and policy decades later.

The mismatch in timeframes

The timeframes of politics are short: the present 24 hours, the next seven days and the approaching election are critical punctuation marks. The timeframes of science, technology and innovation are long: results are delivered over years, sometimes decades – usually long after the government that originally funded them has become history. MPs understandably see few immediate political payoffs from a decision to bolster science funding, or even from a decision not to cut it.

On the other hand, science is seldom professionally equipped to deliver results or information with the immediacy, clarity, simplicity and political relevance demanded by MPs.[6] It is ill-accustomed to translating its outcomes into present-day or immediate future social and economic benefits with which politicians may wish to associate themselves.

Yet this is what science has to do if it wishes to demonstrate its engagement with the political system. It needs to explain its activities in terms of the political, not the scientific, timetable. Politicians, more than any group, are conscious of the fragility of promises: to them a scientific promise is no more reliable than a political one. They need to see it being delivered here and now, or at least in the very near future. They'd like to take some credit for it, or share a bit of reflected glory. They would like to see science actively improving the lives and jobs of their electors.

Scientists, of course, are forever scrutinising the future, often the distant future. So much so, in fact, that they may have completely lost interest in the work they did three, four or five years ago, and that is at last starting to have a meaningful payoff for society or industry. Consequently, they omit to communicate to politicians the *present* benefits of *yesterday's* work. Sound science communication ensures that the process of knowledge

sharing goes on long after the actual R&D has wound up, and keeps current benefits of old research fresh in the public and political mind.

Electoral 'clout'

The number of people employed in research and development in any country is seldom more than one per cent of the voting population and, in developing countries, a great deal less.[7] Researchers are generally distributed fairly evenly across electorates, which means that science and technology issues rarely influence the election outcome in a particular constituency or determine the future of an individual MP, let alone the fate of governments.

From a political standpoint science thus lacks political 'clout'. It has nowhere near the local influence of a major industry or even a big factory, or the national influence of a sector of the economy or category in the community.

A second reason for this lack of electoral clout is that scientific institutions are rarely politically astute enough to join forces with industries or groups to whom politicians pay attention. The academic desire to remain uncontaminated by the grubbier aspects of industry or interest lobbying is understandable and laudable. However, this should not prevent research institutions from joining forces with powerful lobby groups on particular matters of national public interest, or from recruiting industry groups to lobby on behalf of science.

Political 'scientific literacy'

Taking the Australian Federal Parliament as an example, only 16.5 per cent of MPs and Senators had professional qualifications in science, technology, agriculture, engineering or medicine in 2001. Fewer than six per cent of all MPs held science degrees.[8] These levels are likely to be mirrored in many other legislatures, especially in developing countries. Not only do most politicians have scant familiarity with how science and innovation systems function but, as previously noted, they do not always automatically connect them with issues such as employment, wealth generation, security or sustainability. However, scientific literacy among MPs and Ministers, although helpful, is not an absolute requirement for the adoption of scientifically sound policy or of sound science policy. It is more a question of the quality of the relationship between scientists and legislators, and of the character of the communication between them.

Keir recalls 'Herculean efforts' by two Ministers who were sympathetic to science to create better policies by involving scientists with policy-makers (who were mostly economists). 'The theory was commendable,' she says, 'but in practice the scientists and economists found it difficult to agree on what should and could be done. Policy-making often cannot wait for the science to be completed'.[9]

She concludes that good practices may be easier to achieve than good policies, and that joint research and implementation ventures between government and science organisations are both appealing and produce good results.

In his analysis of the shortcomings of science in communicating with its various audiences, Roederer[10] puts the boot firmly on the scientific foot. He says:

> *We are witnessing an alarming erosion of public trust and political support of science and knowledge-generating institutions, to the point that some outright anti-scientific threads have become evident in many parts of popular thinking.*
>
> *I believe that to a large extent we have to blame ourselves for these problems! I believe we scientists indeed are naive and socially ineffective – maybe reasonably good communicators in the classroom, but generally bad communicators with the public, the media and the politicians.*
>
> *Indeed our greatest threat may not be the scientific illiteracy of the public, but the political illiteracy of scientists!*

The cultural divide

To politicians, perception – what most of the public appears to believe at the time – is the reality within which they operate, regardless of personal conviction. Scientists deal in measurable data, whereas politicians mostly travel on gut feeling, combined with opinion polls, to forecast how an issue will play out.

Scientists often find it hard to accept the apparently irrational forces of popular belief and prejudice that sway democracy. They are uncomfortable operating in a world in which perceptions, rather than facts, predominate. Indeed, researchers not infrequently voice disparaging opinions of politics and politicians on this account, which are unhelpful to the process of building a working relationship. There is a tendency to overlook the fact that the whole of democracy is a giant negotiation and a series of tradeoffs, in which facts may be less significant than opinions, beliefs and the concessions that must be made to them.

Because of this, many scientists are inclined to shun engagement in the public policy debate out of a fear of having their findings weighed in the same scale as popular prejudice, or distaste for the horse-trading that accompanies every major decision. To the politician, however, such reticence may appear like a lack of confidence in the science.

Once again, professional cost/benefit and social benefit analysis can help to bridge the gap.

The linguistic divide

Scientists speak specialised languages without realising how pompous, opaque or excluding their words may sound to others, including politicians. Politicians, too, have a language that, to scientific ears, sounds curiously selective and evasive. Asked in one survey, 'How is science travelling at the moment?' 84 per cent of MPs responded: 'Not well'. When asked why, some said lack of funds but most blamed it on poor communication by scientists.[11]

Poor communication refers directly to the use of jargon and not meeting face-to-face, but it also refers to scientists' failure to translate their arguments into terms critically relevant to a political audience: effect on the economy, on jobs, on public opinion, on various vocal interest groups, and on current high-profile political issues.

If one asked most scientists to explain the impact of their project on public opinion, one would be likely to encounter a blank stare. Yet this is precisely the sort of information politicians need when they evaluate the political risks and advantages of various courses of action.

Throughout this book we argue that effective knowledge sharing requires early and constant feedback between science and society, with knowledge travelling in both directions. It requires the scientist to acknowledge that the community, too, is a possessor of knowledge about its own needs, values and preferences which can complement and assist the knowledge developed by research. If this takes place, not only is the ultimate technology likely to enjoy a smoother path to adoption or commercialisation, but the scientist no longer need look blank when asked by a politician what the community is likely to make of their findings.

In addition to speaking eloquent physics, chemistry and biology, today's scientist also needs to speak politics.

Improving the science/politics relationship

For all the foregoing reasons, science and support for science are rarely regarded by politicians as essential to political success, or among the highest national priorities.

Scientists are far from alone in feeling they get a rough deal from politics. Many industries, professions and community groups consider themselves short-changed by the political system: farmers, miners, business, non-government organisations, welfare agencies, unions, environmentalists, the sports and arts, to name a few. Like scientists, these groups share a conviction that *their* activity, in particular, is central to the nation and its future.

One salient difference between science and other groups is that the others have mostly adopted modern, professional, cohesive approaches to the task of influencing policy and persuading decision-makers. The scientific approach is years, if not decades, behind the times, which is a little strange considering how futuristic the orientation of science is in other respects. As one MP put it:

> *The science lobby has to become more ruthless and persuasive to convince politicians that science should be backed.*[12]

A 'professional' approach to government does not mean the hiring of high-priced lobbyists or PR firms, although a little advice from them on what works and what doesn't never goes astray.

The secret is for scientific institutions to learn to put themselves in politicians' shoes, to see the world through political spectacles or, bluntly, to understand their customer's needs better. This does not require every scientist to become a *quasi* politician. But it does mean having skilled individuals on staff who know how the political mind works and who are in touch with current issues and events, and a leadership who are comfortable and experienced at working with politicians. And it means having one's case couched in political rather than scientific terms, backed up with straightforward and professional cost/benefit and social benefit data.

To plagiarise J F Kennedy, it involves asking not what politics can do for science, but rather what science can do for politics.

What MPs want from science

Research by Australia's CSIRO looked at how MPs obtain information about science and technology, and how they use it.[13] A Federal MP focus group said their main interest in, and use for, scientific information lay in the areas of:

- the current political agenda;
- current public concerns;
- global developments;
- new and emerging issues;
- important scientific advances; and
- current research projects.

They indicated that they mainly obtain scientific information from:

- the Parliamentary Library;
- the web and email;
- organised science briefings;
- personal briefings, as requested;
- committee briefings;
- visits to research sites;
- the media and newsletters;
- their advisers; and
- CD-ROM and video (low).

The MPs said they used scientific information for:

- helping with policy development;
- internal party discussion and debate;
- material for speeches in public and in Parliament;
- to counter incorrect information by interest groups; and
- to promote investment in science.

Their main requirements were that scientific information should be:

- timely;
- relevant to current political issues;
- in plain language;
- re-useable by MPs;
- accessible out-of-hours;
- from a credible source;
- provided at various levels of detail;
- with executive summaries; and
- with case studies and 'stories'.

Other key elements stressed by MPs as helpful in building a partnership between science and politics were:

- fast access to the right scientific expert, a directory or point of contact;
- a face-to-face relationship based on mutual benefit, not a series of one-off contacts with random scientists hustling for funds;
- scientific information packaged in small, regular and digestible chunks rather than huge, confusing dollops or long, jargon-laden reports;
- use of concrete examples to explain science, instead of abstractions and generalisations;
- use of the 'story' technique to describe what happens in science, and engage the listener or reader; and
- personal visits to labs and scientific sites to generate insight, enthusiasm and personal contact.

The stand-out factor here is that politicians all want scientific advice about the current political hot issue *now.* They don't want advice about yesterday's hot issue, or even tomorrow's (except in rare circumstances), and certainly not next week's or next year's. Scientific institutions are usually ill-prepared to satisfy these instant demands for information yet their performance and value to the nation is being subtly appraised by politicians on whether they can do so.

In reality this is not such a tall order as it might appear, as the political demand is mostly for simplified and background information rather than intense detail. The maintenance of a comprehensive file of issues briefs – in paper and electronic form and compiled by someone who is well-informed about what is going on in the legislature and what is coming up and can write lucidly – will usually suffice.

Fostering the dialogue

Former Australian Labor Party federal secretary Dr Gary Gray, who later became a science manager, offered the following rules for improving the dialogue between scientists and politicians.

1. Research is about wealth generation and the future, not just science. Focus on things like jobs, improvements in living standards and a cleaner environment.
2. Engage politicians and community leaders locally. Inform them and help them to understand the issues.
3. It will take time to create a culture of understanding for science in politics. Don't expect a single meeting or a quick fix.

4. Science can win by steadily building a case for science.
5. Articulate outcomes, and what the science means, in plain language.
6. Be an enthusiast for all science, not just a lobbyist for your own discipline or institution.
7. Build support methodically. Start by inviting MPs to visit your institute.
8. Be conscious of the political cycle.
9. Talk to all sides, including minor parties. Remember that today's Opposition is tomorrow's Government and today's backbencher is tomorrow's Cabinet Minister.
10. Be informed about the legislative process.
11. Be useful to politicians. Don't raise problems unless you have solutions to offer.
12. Keep dialogue simple and factual. Substantiate your claims from reputable sources.

Gray stresses the importance of building a dialogue between scientists and politicians as the primary requirement for developing a stronger scientific culture in politics. It is not good enough, he says, simply to demand money for research.

He urges scientists to avoid berating politicians, but instead to try to win them through an infectious enthusiasm.

'Remember,' he advises scientists, *'when you meet with a politician, you are no longer only a scientist. You, too, are a politician'.*

Similar advice comes from Physics Professor Juan Roederer. He counsels scientists to do their homework first: find out the politician's specific responsibilities, political views and personal interests. Prepare a case using simple metaphors or examples they will relate to – don't improvise during the talk. Keep key points and data on cue cards for ready reference, remembering that politicians are great debaters, ready to leap on any inconsistency.

Roederer also has an excellent list of 'nevers' for speaking with MPs:

- never talk about yourself unless asked;
- never mention money unless asked;
- never contradict a politician ever if you disagree with him or her;
- never make a statement the politician may interpret as a threat;
- never use acronyms or scientific jargon;

- never hand scientific or technical papers to the politician;
- never take up too much time;
- never raise unrealistic expectations about what science can deliver or what it predicts will happen; and
- never appear condescending.

Building a comprehensive relationship

The links between a scientific institution and government must occur at many different levels and in varying ways. Typically, the points of contact consist of some or all of:

- the Ministers for science and various industries or sectors;
- Cabinet submissions and requested policy advice;
- senior staff and advisers to the Prime Minister (or President) and Ministers;
- senior public servants and departments with an interest in science, and their committees;
- Parliamentary policy committees, on request;
- government science advisory groups;
- individual members of the legislature and their staff, on request;
- policy committees of political parties, on request;
- the political media; and
- Parliamentary information sources, such as the library and information network.

The following are some tested ways that links between science and politics can profitably be enhanced.

National science briefings[14]

This was a series of special briefings staged in the Australian and Indonesian Federal Parliaments to provide MPs and their advisers with up-to-date scientific insights into issues of current political interest or moment. It was developed by Wendy Parsons for the Australian Parliament and by Sari Hartomo for the Indonesian Parliament. Each briefing involves two or three speakers from different institutions or backgrounds including industry, each limited to 10 minutes and using the latest presentation aids (e.g. Powerpoint, multimedia, hands-on demonstrations). Speakers are carefully coached, purged of jargon, focused on the political (as distinct from scientific) needs and their notes are available afterwards on paper, by email and web and from the Parliamentary library.

The aim is to show politicians (and their advisers) how science can help them to make better policy decisions. It is to promote the value of science to politics. It is *not* to brag about a scientific institution or lobby for funds – which would undermine the very purpose of the briefing. It is to send a message that scientific knowledge can be of service to good policy-making.

It is desirable for such briefings to be supported or sponsored by all the main national science organisations to avoid mutually destructive jealousies and the sort of infighting that so discredits and disadvantages science when compared with other, more organised and disciplined industry or community lobbies. It is helpful if the Science Minister or a senior politician hosts each briefing.

State science briefings

This is a similar series of briefings designed specifically for State and Provincial legislatures. Here the accent is on how science can contribute to local and regional development, to the progress of particular local industries and to help tackle local environmental issues.

It is advantageous if prominent figures from local industry or the community are among the speakers and seen to be working in partnership with scientists. This gives politicians a strong sense that the science being advocated is also politically sound in the local electorate.

Science updates for electorates

This is an email service precision-tailored to the needs and interests of individual politicians. It notifies them, in brief, of scientific discoveries and outcomes directly affecting their local constituency.

It is based on a database containing information on the main industries and sources of employment in each electorate and the personal interests of individual politicians. For example, an advance in cattle nutrition might go to politicians with a dairy or beef farming industry in their electorate, while an advance in breast cancer screening goes to politicians with a particular interest in women's health issues.

Because politicians are absolutely inundated with paper and information, the email is not sent directly to them. Instead it goes to that invaluable but obscure person, the electoral adviser. This is the person who manages the

MP, constantly briefs him or her about the state of local opinion, local issues, local concerns and what has to be done and said as they travel around the electorate.

The idea is for the electoral adviser to use the information to help the politicians find good things to talk about as they address community or industry groups, give interviews to local media or write their columns and newsletters. It is a subtle way of making the politician proud of, and take ownership of, scientific achievement. It also employs the politician as a messenger and advocate for science.

The intention, over time, is to raise a generation of politicians with a fuller appreciation of the value that science and technology can bring to local issues, industries and people's lives. By the time they become Ministers, it is hoped, they understand more clearly the importance of investing in knowledge to the economy and society.

Discoveries in big national research labs seldom receive local media coverage for the simple reason that they are national, not local. However, the inclusion of the local MP's name magically transmutes the science into a local story, so this is another way to increase general media coverage of R&D.

'Science meets Parliament'

This has been a particularly successful experiment by the Federation of Australian Scientific and Technological Societies (FASTS) to bring scientists and politicians into face-to-face contact. It involves scientists leaving their familiar turf and meeting their MPs and Ministers on their own ground, which helps convey a sense of the atmosphere, pressures and real-life working conditions in politics. It is a nice complement to arranged visits for MPs to laboratories.

The day enables researchers and MPs to meet informally to share information and build personal relationships. The visiting scientists come from all disciplines and institutions and are very carefully coached beforehand on how to prepare for their meetings, especially on what not to say (e.g. 'Don't mention the 'M' word!'). The accent is on advocating science in general, not individual disciplines or organisations.

MP visiting program

Most science organisations welcome MPs into their laboratories, but few have an organised program of visits designed to reach across the whole Parliament over time. Often there is a focus on Government MPs and a neglect of Opposition MPs who may, one day, occupy the Government benches. Equally, there is a focus on Ministers and senior figures and a neglect of junior backbenchers who will one day grow up to become Ministers and Prime Ministers.

The rules for a successful MP visiting program are as outlined above: the information must be clear and attuned to political needs, the topic of money should be avoided unless raised by the guest, and great efforts should be made to demonstrate the *value* of scientific outcome to the community or nation, as distinct from just the scientific process and its equipment.

MPs, by and large, are fascinated visitors to scientific sites and ask lots of questions, which are mainly oriented to how the community is going to respond to the new science or technology. It's a good idea to give them something 'hands-on' to do, like spooling DNA. We all learn better by touching and handling. If the MP is one of those who were turned off science as a student, it was doubtless because of the books: a hands-on experience offers them a way back into the wonder of discovery.

'Science ambassadors'

These are prominent non-scientists, such as industrialists, financiers, artists, media, religious and community figures who have agreed to act as advocates for science to Government and the wider community.

The aim is to demonstrate to politicians that science has a broad base of community support, which they cannot afford to overlook in their political calculus. In the same way as Brigitte Bardot was used to promote the environmental cause or Princess Di the land mine issue, this advocacy is designed to provoke interest, attention and curiosity on the part of the audience.

'Ambassadors' can be used to advocate on specific issues, or for the general principles of national scientific investment, literacy and knowledge sharing. It is important to reinforce their arguments by having them also appear in the media, so the politicians 'get it in both ears'. A media presence is one indicator the politician employs to assess the political significance of an issue: no coverage, no issue.

Briefing notes

One way for the scientific institution to keep up with the astonishingly fast pace of politics is to create a series of backgrounders or briefing notes on critical issues, which can be easily accessed as the issues surface.

These need to be carefully tailored to MPs' information needs, not just recycled scientific reports or press releases. They need good, clear executive summaries with dot points. They need to make the information available at several layers of complexity and detail. They need up-to-date cost/benefit estimates or risk appraisals. They need to provide 24-hour contact with the relevant experts.

They should be available several ways – as paper handouts, by email, on a special Parliamentary website and in the Parliamentary Library. They should be available to senior public servants responsible for briefing Ministers and committees. They can be available to industry or community lobby groups to reinforce their own arguments. They can be available to provide background to political journalists when an issue breaks. All this ensures that consistent scientific information flows into the political system from several directions at once.

Customer value analysis

Customer value analysis (CVA) involves regularly polling and interviewing MPs for their views on the state of science and technology, and their scientific information needs. It is a cheap and effective way to make sure the scientific message is carefully attuned to the political need. It is also a way of helping the scientific institution to appreciate that politicians are actually their customers, not merely their sources of funding. The technique is described in detail in Chapter 12.

We recommend two kinds of research: short, simple questionnaires covering a cross-section of politicians and political parties, and more detailed qualitative analysis using a focus group of 'typical' MPs to help interpret the results and provide detailed feedback. One way to do this is to recruit the members of a Parliamentary standing committee dealing with science.

Having a staff member work in a politician's or Minister's office is another invaluable way of attuning the organisation to political requirements for information, the preferred form and modes of delivery.

Key account management

Key account management means having a central person or office within the scientific institution whose job it is to keep track of all the various contacts that are being made with the world of politics and government to help coordinate them, make the approaches consistent and prevent the organisation from tripping over its own feet or contradicting itself; in other words, to monitor and supervise the total relationship. The concept of key account management comes from the advertising industry, but it has features from which science and knowledge sharing can benefit.

One of these is the use of a central computer database that logs all current and past contacts with government so that any individual with access can see at a glance what has gone on before, what is happening now, and who is talking to whom. Apart from better organising the institution's own dealings with government, this also helps it to work far more effectively with other scientific bodies or industry lobbies, and so present a more unified and disciplined front to Government.

Two cultural changes are essential for this to work well:

- the 'begging-bowl' model of science lobbying must be replaced with the 'science of service' model; and
- the dog-eat-dog academic tradition of pressing one's case for support over that of other disciplines and institutions must be replaced by a whole-of-science or science-with-industry partnership approach.

Relationship-building with both politicians and bureaucrats requires, hard, dedicated and persistent investment of time and people. To begin with it may involve initiating contacts with MPs or senior public servants to offer assistance. As they come to view the organisation as helpful to government and the policy process – as opposed to lobbying in its own vested interest – they will begin to call for advice.

Cost/benefit analysis

A salient difference between the worlds of science and government is that government is largely run by economists who want to know what something costs and what the return will be. In the era of economic rationalism, this demand was focused almost exclusively on dollars and cents. Like other industries, science has to account for its activities according to the triple bottom line of economic, social and environmental outcomes. Added to this it is having to report against an every-growing list of bureaucratic performance indicators and targets that make no distinction between the outcomes of science (which are hard to predict) and the outcomes of welfare or industry policy (which are easily measurable).

Yet few scientific programs can produce even a half-credible set of economic figures from their bottom drawer when questioned about the value of their work, let alone all the other stuff.

Scientific institutions suffer from an understandable desire to devote every possible dollar to research activity and as little as possible to 'administration'. There is sometimes a naive attitude that any dollar not devoted to research is a dollar wasted. However, this ignores the fact that science dollars do not simply materialise on trees, but rather must be argued and cajoled for, negotiated, justified and accounted for. Failure to invest a strategic percentage of an organisation's global income in this activity is liable to lead to a reduction in research funding in the longer term.

As a rule of thumb, every major scientific research program should be accompanied by at least some basic, professional cost/benefit and social benefit analysis. This does not mean top-of-the-head estimates. Ideally, one program in ten will be subject to independent evaluation. Some attempt should also be made to garner community feedback at an early stage in the research, both to help lubricate adoption or commercialisation and to assure government that the money is being spent in a way the community approves.

Old habits, like 'science knows best', die hard. But die they must if science is to persuade the 21st century community of its value and relevance, respond more fully to its needs and share its findings more widely and equitably. Those institutions able to adapt most swiftly to the age of modern social and economic accountability are likely to find themselves at a Darwinian advantage over the rest.

Chapter 5

Communicating with industry

Private industry is one of the most effective and valuable means for science to share its knowledge with the community, the nation and the world at large. The successful transfer of science and technology to industry is viewed as an important indicator for defining the value of a research establishment to the community it serves and a determinant of the level of public, as well as private, funding it receives. The market orientation of industry to its customers imposes an exacting discipline on science to try to make its knowledge outputs as useful and useable to the wider community as possible.

This ought not to conflict with the duty of a publicly supported research institution to carry out public good research, although there are plainly times when it does – or when the two make uneasy partners. There are also times when tensions arise among researchers and units – between those who see their role as focused on the needs of industry and bringing in commercial funding, and those who regard themselves as operating on behalf of the public good or pure discovery and who see private funding as tending to distort or detract from this ideal. There is no simple solution to this tension – indeed it is healthy to have it – but in communicating the outcomes of research and sharing knowledge there is unquestionably a viable middle ground.

One way to harmonise the apparent dissonance between commercial science and public good science is to regard companies with whom an institution works as the proximate, or immediate, customer and society or consumers as the ultimate customer. This dual focus allows the research body not only to meet the needs of its immediate industry customer, but also to ensure that the knowledge product is more likely to be successful and widely adopted by society.

If private companies had a monopoly of wisdom about the market, and perfectly understood their clients, there would never be any bankruptcies. There would be no bears on the stock exchange, only bulls. Yet scientific institutions frequently behave as if industry are all-knowing with regard to the needs of its customers and the marketplace in general. The consequence is that many technologies that are successfully transferred to industry fail the ultimate test of commercialisation, which is to be widely purchased and used by consumers or by second and third tier industries in a vendor pyramid. As a result, the investment in the original research is not fully realised, and the knowledge not optimally disseminated.

We propose that the best way for science to help industry is to have a strong understanding of industry's own customers and *their* needs, right down to the ultimate consumer. If this process is observed rigorously, the public interest – at least as expressed in the views of the public itself – will also be served. Furthermore, by having had input into the early part of the research process, the community will be reassured that its views and values are being taken into account in the development of new products or processes, and will be more receptive to them when they become available.

The objection will be voiced that this violates commercial confidentiality – but there are plenty of ways to incorporate representative community views into a confidential process without letting one's competitors in on the secret: companies use them all the time when doing their own market research and product development.

A good example of this process at work is the 'Cassandra Report' developed by Food Science Australia, a food research institute affiliated with Australia's CSIRO. The first step was for researchers at Food Science Australia, using their scientific and technical prowess, to project all sorts of exciting new products and processes based on state-of-the-art knowledge in their field. The second step was for leading food companies to outline their ideas of future products and processes and the trends they foresaw in the processed food market over the coming decade. The third, and critical, step was to show the combined list of ideas to consumers, who were then invited to pick and choose what they wanted. The result was an interesting selection of novel foods and technologies that were scientifically feasible, commercially attractive and desirable to consumers. Interestingly, the consumers sometimes selected quite different products to those that either the scientists or industry had tipped. A significant point about this process is that the inclusion of consumers in the discussion at an early stage can dilute the commonly held notion that industry and science are insensitive to consumer wishes and needs. The result of such processes will be advances that satisfy everyone's requirements better, and more rapid uptake of new knowledge.

In developing countries, where the gap between a multinational corporation and the rural poor is extreme, the importance of holding such a conversation is even greater. There will often be profound cultural, religious, ethnic and other belief-and values-driven factors that radically affect whether a new technology or product is accepted or not. Scientific institutions in these countries can play a vital role as the facilitators of this discourse, helping to bridge the abyss between the rural poor and large urban and global industries. One of the most valuable elements in this feedback process is to give large companies a clear idea of what the poor can and cannot afford, what level of technology they can cope with and of the importance of providing free or extremely low-cost knowledge as an initial gesture of good faith – as well as a way of increasing their disposable incomes.

Any global corporation that is serious about expanding its markets and client base in the 21st century will consider ways to provide the kind of knowledge to developing countries that will enable poor people to help themselves and to lift their own incomes and living standards. Although the corporation's ultimate goal may be to sell more vehicles or computers, or entertainment or medications, a truly strategic approach to doing business will be to enter a conversation with developing countries about how best to help them meet their needs for better agricultural and environmental know-how, improved education delivery, village-scale manufacturing and processing activity, and low cost water, energy and health care systems. Corporations arguing that delivery of these sorts of services are the province of government have yet to come to grips with their role as global citizens, and have not fully appreciated that there are billions of potential customers out there if they could earn enough to afford the company's goods.

In the coming years, enlightened companies will come to see it as their role and their responsibility, both as world citizens and as astute investors, to help to share knowledge among the poorest of the poor and among those who lack easy access to information they can use. Very often this knowledge will be of the most basic kind, concerned with food production, housing, health, education and the like. It will probably be quite remote from the main corporate enterprise, but can nevertheless be delivered by endowing local scientific institutions, science communication, government extension services, non-government organisations and local community development agencies, education and technical training. Scientific institutions in the developed world seeking to share their knowledge more widely in developing countries will also start to find willing sponsors and investors among these enlightened businesses.

In this way the partnership between science and commerce can come to have a far deeper public good significance.

The rest of this chapter offers general guidance and ideas for ways that science can communicate more effectively with industry.

Identifying community needs

As discussed above, it is important for science to have a clear idea of the wishes and needs of the ultimate customer, the consumer or general public, when it enters discussions with industry about its needs.

Economical ways to do this are covered in detail in Chapter 12. They consist primarily of:

- independent quantitative research into public needs and priorities;
- a literature search of other publicly available survey findings in the relevant field;
- careful analysis of the market segmentation for various products and processes;
- qualitative, or focus group, research to determine the factors that lie behind strongly-held community wishes or beliefs;
- inclusion of consumer advocates, community, environmental and health representatives on scientific advisory panels;
- face-to-face discussion with experienced advertising consultants and marketers who understand the main drivers in particular markets, or mass psychologists who understand the motives behind community beliefs and values; and
- detailed discussion with any groups likely to be provoked, angered or hostile to the proposed research (e.g. environmental lobbies, religious groups, minorities) to understand their motivation.

Identifying industry needs

Critical for successful commercialisation of science is for the institution and its scientists to get inside industry's head. The following suggestions have been shown to work well by scientists at LIPI in Indonesia[1] and CSIRO in Australia:

- face-to-face consultation between senior industry executives and research leaders, followed by meetings between technical staff and front-line researchers;
- market research and analysis to identify potential for new products and processes, with attention to market segmentation, targeting and product positioning;
- regular industry/science priority workshops to review and adjust goals and priorities;

- employment of industry specialist staff and trained business managers by science organisations;
- creation of industry advisory groups, and using them effectively by asking the right questions;
- adoption of key account management principles in dealing with industry groups and individual customers (e.g. develop a customer database);
- programmed visits by researchers to industry to identify problems and explore research opportunities;
- visits by industry R&D managers to science centres to observe capability and explore research opportunities;
- surveys of industry R&D managers' needs and priorities (both questionnaires and face-to-face);
- joint commissioning of feasibility studies and market research into new products and processes;
- customer value analysis (see Chapter 12 for details);
- regular attendance by researchers at industry conferences, conventions and workshops;
- science centres taking out membership of industry associations and professional bodies;
- joint development of industry research networks, seeking to bring in ideas from as wide a field as possible;
- industry/science exchange programs, whereby scientists work in industry and industry technical staff work in science centres;
- secondment programs that place scientists in industry for periods of six months or longer;
- science centres encouraging their staff to undertake leadership roles in industry and professional bodies;
- wider subscription to industry journals in the science library, including specialist newsletters providing advance intelligence of important developments;
- subscriptions to the financial media;
- inclusion of industry technical specialists in internal seminar series;
- staff news bulletins or notice boards (virtual or actual) containing the latest news and intelligence of industry developments;
- creating awards to honour effective partnerships with industry and successful commercialisation;
- development of reward and incentive structures, including profit-sharing and royalty-sharing deals, that allow scientists to benefit from having good relations with industry;

- joint seminars and training courses in intellectual property (IP) management; and
- running courses for scientists in listening skills, negotiation skills and how high-technology businesses are managed.

Communicating science capability to industry

Many of the initiatives outlined above will allow the research organisation scope to advertise its capability and share its knowledge more effectively with industry, because they are designed as two-way exchanges – both to listen to industry's views and needs, and to explain how science can help meet them.

However, there are also many other tactics the science institution can adopt to raise awareness of its skills, capability and achievements in industry. These include:

- obtaining increased coverage of its work in the financial and specialist industry media (see below);
- participating in industry exhibitions, displays, field days etc.;
- collaborating with industry in new product launches;
- strategically partnering the science brand with industry's top commercial brands in publicity and media coverage (see below);
- conducting industry briefings on the latest scientific and technological progress (see below);
- including an 'agreement to publicise' clause in all (or most) research contracts with industry (see below);
- obtaining recognition from government and community leaders for successful work done in partnership with industry;
- helping industry to tell its story to government;
- providing industry with an up-to-date directory or e-directory of scientists, their expertise and contact details;
- making sure that its latest advances feature on the most-used industry websites;
- electronic marketing, in all its various forms (email, web, multimedia etc);
- preparation of publications (paper and electronic) that are carefully crafted to meet industry's information needs (as distinct from the science body's need to promote itself). These should be concise, written from a business perspective, contain hard financial cost/benefit

data, case studies of successful science–industry partnerships, and be layered to allow busy managers to read at the depth that suits them;

- sponsorship of industry events and awards;
- corporate gifts and presentations that reflect the organisation's scientific capabilities and skills;
- industry 'ambassador' programs, in which highly respected figures from industry undertake to advocate on behalf of the science organisation to their industry;
- use of knowledge management 'storytelling', proposed by IBM as an effective way to foster collaborative creation of knowledge using a technique thousands of years old amplified through state-of-the-art media and communication techniques;[2]
- collecting and publicising 'satisfied customer' endorsements;
- collaborating with industry bodies in schools and public education programs and projects, helping to validate industry claims with science;
- providing independent product safety and performance testing, and advice on how to correct problems;
- being visibly associated with the setting of national or industry standards of quality, safety, performance etc.;
- participating in the setting of industry codes of practice by providing objective scientific measurement and advice;
- providing independent scientific advice to industry lobby groups that are seeking changes to government policy;
- acting as an independent umpire or 'honest broker' in public debates and disputes between industry and community groups or non-government organisations; and
- feeding back to industry any findings from the science institution's public opinion research that point to emerging problems for various industries and their products, where these problems can be overcome by R&D.

Business and industry media

The business and industry media are a vital link between science and industry that are all too often neglected. Through this media many industry managers first become aware of the capability and services offered by a scientific institution.

The most effective way of all to put them in the picture is for them to read about their competition stealing a march on their company through effective use of science and technology. Few things work better in industry than stimulating the competitive spirit.

Even if your science organisation is planning a series of face-to-face meetings with senior industry executives, these will almost never take place in a perfect information vacuum. Chances are the executives will already have some impression of what your organisation does, and of its past achievements and current abilities. Chances are they will have gathered this information, or at least part of it, from the media. Business executives are also human beings who watch television, listen to the radio, read papers and magazines and admire heroes. Like most of society, they glean their general knowledge of what's going on from these sources. For the same reason a farmer ploughs his field and fertilises it before sowing a crop, it is a smart move for science bodies to use the business media to work up the ground of awareness in industry.

The principles for communicating with the business media are similar to those outlined in Chapter 3, but here are a few extra tips.

- Science stories should always be cast in business terms and should be angled around business, not scientific, outcomes. Improvements in profit, production efficiency, product design, customer satisfaction, safety, wholesomeness, environmental sustainability and the like are the sorts of benefits sought from science by industry. The best plan is to get a business journalist to write your story.
- Like the general media, business media are a lot less interested in announcements of intention to work on a research project than they are in the actual outcome. It's important not to forget to tell them what was achieved from the partnership.
- Highlight benefits to national economic indicators such as export income, employment, GDP, inflation, consumption etc.
- The business media are increasingly interested in 'triple bottom line' outcomes, so emphasise social and environmental benefits along with financial benefits.
- The business media like 'hero' stories about top executives. Seek to highlight the effective use of R&D among the ingredients desirable in a top 21st century manager, along with more traditional qualities.
- The business media also like large feature articles that project possible futures for key industries. Top scientists who have a good grasp of the industry they work with are in a perfect position to envision the future 10 years or more out, and so stimulate industry interest and debate. Arrange suitable interviews or op/ed (opinion) articles in the business media.

- Business media letters pages are a great place for scientists to stimulate discussion of emerging issues – and implicitly advertise their own wares.
- The business audience accepts 'advertorials' (paid space in a publication or program in which the company's own view is published), and this can be an effective (though more expensive) way for a science centre to reach a very large business audience.
- Specialist journals that serve particular industries such as manufacturing, food processing, IT, fishing, the auto industry, mining, energy and so on welcome stories from science organisations. They are invariably hungry for well-written articles, happy to give them a good, detailed run and generally provide the most favourable coverage it is possible for a science body to obtain in *any* media. Once again, the clue is to write the story from an industry, not a research, perspective. If you haven't got a specialist writer serving this market, get one!
- Business media like graphics. Provide graphs, tables and other visual aids to understanding with any media release or story.
- Business readers enjoy gossip as much as the next human being. Try to deliver your best science-in-industry stories to the leading business columnists, whose writings are the daily fare of business lunches and watering holes.
- Business and industry publications also offer easier opportunities for regular columns by researchers or institutions than the general media. Like all columns, however, you must be absolutely certain you have something new to say each time – not repeat the same old stuff. Also, avoid promoting your own institution – focus on what science can do for industry overall. Use a journalist to ghost it.

Agreements to publicise

Many good science-in-industry stories slip through the cracks because, by the time the commercial partner is ready to tell the story, the research institution has long thundered off in pursuit of something new. The gap of months or years between science leaving the lab and business releasing its product onto the market often means that:

- the science organisation doesn't get full credit for the achievement; and
- the company doesn't reap the full market benefit of having its latest product linked to a reputable science institution.

A journalist sitting at his or her desk is inundated by a tidal wave of company media releases announcing new products or processes. The reason so many of these end up in the waste bin is that the journalist has no way to rapidly assess the truthfulness of the company's statements, and will bin them rather than risk being used as a vehicle for dubious claims, corporate 'PR' or a covert attempt to inflate the share price.

However, if the journalist receives media statements from the company *and* from the science agency *at the same time*, then the science body's reputation for objectivity and integrity will help to validate the company's claims about its new product. This can increase the chances of media coverage markedly. It can also greatly increase the amount of coverage received.

For these reasons it is important to build into a commercial research contract some sort of reminder mechanism that allows both bodies to gather due credit at the time the product goes public (assuming it does go public).

This is the 'agreement to publicise' clause, which binds the parties to work together on the communication of the research outcome to the wider community, as well as the actual R&D.

There is no reason for this clause to conflict with requirements for commercial confidentiality while the R&D is in train. It specifies that, once the period of need for absolute secrecy is past and the company is seeking beneficial publicity, that the two work together in partnership to obtain it.

Of course, in cases where the research is deemed permanently confidential, this does not apply. Nor would the agreement to publicise clause cause the release of commercially sensitive information, such as the details of a chemical or manufacturing process. It is intended only to publicise the outcome of the research in terms of its application and benefit to the community, consumers or immediate customers for the innovation.

Experience indicates that two separate statements – one from the company and one from the science body – work better than a single release incorporating comment from both. For the sake of its reputation for independence, it is better for the science centre to make its own statement and commentary on the product.

Working as 'brand partners'

The use of an agreement to publicise clause introduces an important concept in science communication and knowledge sharing: brand partnerships.

Both partners in a research collaboration – the science organisation and the commercial company – have a public identity or brand that has an intrinsic value. In the case of the company this is readily measured by turnover, profit, share value or a set of performance indicators. In the case of the research institution the brand value is much harder to quantify, and consists of its accumulated public reputation arising out of its known research achievements, perceived trustworthiness, integrity and excellence.

The linking of these two brands around a research outcome holds large advantages for both partners. It is a fresh case in which the whole is greater than the sum of the parts. The commercial brand enhances the science institution's reputation for successfully developing and delivering innovative products that are valued by society. The science institution lends to the commercial company its credibility and reputation for independence, scientific integrity and R&D quality.

Ways in which a research organisation and its commercial partners can cooperate as brand partners include:

- an agreement to publicise clause in the contract;
- collaboration in product launches;
- combining on media publicity;
- working together on innovation case studies that demonstrate public, private and national benefits;
- joint appearances at science briefings, Parliamentary hearings, and commercial and industry forums;
- joint presence in media advertising;
- approved use of the science institution's name in advertising and promotion by the commercial partner;
- approved citation of the science institutions' research findings in product promotions; and
- statements intended to ease public concerns about secrecy, ethics and ownership of intellectual property (see below).

Public concerns

Public opinion research in most developed and some developing countries is showing an increase in public concern about:

- commercial secrecy;
- ethics; and
- ownership and control of research results and intellectual property.

Public trust in scientific institutions may generally be high, but the research indicates that it falls significantly as the public becomes aware of the extent they are working with industry, especially with international companies. This may have serious consequences for public funding of research.

This phenomenon has become particularly marked since the emergence of a debate about globalisation, the growth of the anti-globalisation protest movement and the resurgence of protectionist sentiments in many communities. Science bodies are increasingly forging partnerships with international companies, rather than local ones, because the former can afford to pay for advanced research. Yet local communities and consumers often feel far less sentimental loyalty to the products of a 'foreign' company than they do to a local one. Consequently they disapprove what they interpret as disloyalty on the part of the science body to the national or local interest.

In every case in which a scientific body goes into partnership with a large foreign or international company, or even a local giant, it needs to think very carefully about the public good issues and to make sure they are articulated to the local community and discussed with them.

For the brand of a scientific institution to be of optimum value to industry it is essential to address these public concerns through openness and transparency. Excessive secrecy, or simply a failure to communicate, will tend to reinforce public suspicions about the value of the national public investment in R&D, and the motives and ethics of science agencies.

Industry briefings

These are one of the most effective ways to build dialogue and understanding between science and its customers in industry. The following advice was developed by the Indonesian science agency, LIPI.

- A successful industry briefing is not a single-day activity. It needs careful preparation, as well as effort and energy.
- We aim to build a sound relationship with industry well in advance. This means being involved in industry activities, taking membership in industry associations, ensuring good coverage in the industry media etc. Developing personal contact with senior executives and top figures in industry is critical, as they make the decisions for their companies and can be highly influential over opinion in their industry. They can also open many doors.
- Building and strengthening the confidence of industry in our institution is a prerequisite for conducting a successful industry briefing.

- Industry briefings have three purposes:
  1. to gather input on industry's needs and how they see future trends in their field;
  2. to obtain feedback on your scientific products and services; and
  3. to introduce the latest research achievements relevant to industry customers (where these are not confidential).
- These three functions can be carried out together, but it is advisable to focus on one function at a time as this will bring a more effective result.
- Industry briefings succeed best if they are carefully focused on a selected field of high relevance and interest to industry. Selection is usually based on a combination of current 'hot topics' and the science agency's capability and capacity.
- People in industry are normally very busy and their time is precious. We must present our work in a direct and concise way, and provide business analysis of it. At the briefing there must be no distinction or boundary between scientists and industry people.
- We recommend a half-day briefing focusing on just one of the three purposes listed above. This allows busy executives the rest of the day to do their job. It also looks businesslike.
- Provide all briefing participants with a smart and eye-catching information sheet to support information conveyed verbally during the briefing.
- Invitations should be sent out well ahead. Two weeks is the minimum, but for senior executives far more notice is needed, as their diaries are filled 6–12 months or more in advance.
- It is a good idea to announce forthcoming briefings at the current event so participants can put them in their diaries.
- Notify industry media about a forthcoming briefing well in advance (i.e. at least 2–3 months prior), bearing in mind their deadlines (which may be monthly) and how often they publish. Give their readers enough time to log your event in their diaries.
- The media should also be invited to attend the briefing itself, as they can help bring the message to any industry executives who may have been unable to attend in person, as well as to a wider audience.
- Industry participants from previous meetings can also be invited to nominate or bring along colleagues to the next meeting.
- In preparing material for the briefing, great care must be taken to pitch it at the correct technical level for the audience, and some previous research into their qualifications and experience is highly desirable.

- During the briefing, avoid the inclusion of speakers who know little or nothing about the topic, even if they are senior executives of the science agency. Effort must be made to avoid giving industry the impression that science is bureaucratic and obsessed with hierarchy. If you use a non-specialist to welcome the guests, make sure that person's talk is short and relevant.

Communicating with agriculture and the rural sector

Farmers and rural workers, whether in the developing or developed world, are one of the most important target audiences for knowledge sharing. Most of the world's population still lives and works on the land, and the majority of the world's farmers are women.

Even in remote, poor and far-away places, agriculture affects the lives of people living in wealthy cities who, on the surface, might consider themselves insulated from its ups-and-downs. The success or failure of agriculture in developing and developed countries can spell:

- the difference between peace and war;[3]
- the probability of refugee crises;
- significant impacts on the global economy, trade, jobs and interest rates;
- large impacts on the global environment and biodiversity, and on the ability of the earth's resources to sustain the total human population;[4]
- significant effects on health and nutrition in both developing and developed countries; and
- whether or not the population grows, stabilises or shrinks.

The failure of agricultural development is a basic factor underlying the failure of government in so many crisis-prone regions. Stable political systems are unachievable when people are starving or fighting over scarce resources.

The ability of the developed world to share knowledge about sustainable ways of producing food, fibre and timber in such a way that it is appropriate to the cultures, peoples and settings in which it is received is, perhaps, the central issue of the human destiny in the first half of the 21st century. However, it is also important that the developed world more effectively distributes knowledge of sustainable systems and the production of healthier food among its own farmers. From either perspective, the sharing of agricultural, forestry and marine knowledge will be a primary determinant of humanity's common future.

There are many well-tested ways to share knowledge with farmers, fishers and foresters, such as:

- government extension services;
- private agricultural consultants and advisers;
- university outreach activities;
- promotion by agricultural technology companies;
- rural newspapers, radio, TV and video;
- increasingly, through the web for those farmers who have access to it;
- farmer groups dedicated to achieving improvements in productivity such as ‘harvest clubs’, breed societies etc.;
- LandCare, SeaCare and other groups dedicated to a more sustainable agriculture or fishing industry;
- farming or fishing cooperatives;
- agricultural schools;
- field days;
- rural shows, displays and exhibitions;
- Church and religious groups;
- mail delivery of fact sheets;
- circulation of extension tapes to local radio and TV stations;
- hotline advisory services; and
- expert columns written for local newspapers.

In some cases, knowledge can be delivered in forms that the farmers themselves do not need to fully understand (e.g. as new high-yield and disease-resistant strains of crops and livestock). However, care must be taken not to upset the delicate machinery of farming, social and agro-ecological systems that have evolved over centuries.

One of the most important lessons from years of extension research is that primary producers, whether in the developed or the developing world, prefer to get their new knowledge and information from another primary producer, as distinct from a scientist or extension worker. In the developing world, the official in the neatly-pressed white shirt tendering advice to peasant farmers whose families have been producing food for the past few thousand years can be more an object of suspicion than of assistance. A key to successful transfer and uptake of knowledge in rural communities is the ‘early adopter’, the adventurous farmer or fisher prepared to take a few risks with his or her livelihood to try out a new, possibly more productive, method. This person often performs the invaluable role of integrating a new technique into a traditional production system – of making it work properly in their culture or farm management set-up.

The early adopter is the producer over whose boundary all the other producers gaze – a constant object of interest, suspicion, admiration and cynicism in village or bar-room discussion. The greatest value, in knowledge sharing, lies not in the early adopter's successes but in understanding his or her mistakes.

Such people are often used in government or agri-company field days. They are a mainstay of farm productivity and LandCare groups. However, one place they can be used much more effectively is in the rural media – in farming newspapers and, in less literate societies, on radio. By discussing the challenges they faced in adopting a new piece of technology or method, by telling their story of failure, error and ultimate success, they are one of the outstanding ways to share knowledge in a rural community.

Another technique involves getting primary producers to discuss new techniques in a setting where they are not afraid of disclosing their own ignorance among their peers. An Australian researcher, working to reduce agrichemical use in Asian grain farming systems, recounts that by simply videotaping farmers at work in their fields and then replaying the tapes to the village at night – to the delight, amusement and fascination of all present – he managed to stimulate a wide discussion about better ways to farm without chemicals. No single farmer was particularly exceptional in his approach, but among all of them there were valuable take-home lessons and clues that the videotape brought together as a starting point for the discussion.

At another level, an Australian scientific institution placed a dozen pages of editorial in every issue of the leading magazine for farmer-innovators. The articles were drafted by scientists and then re-written by agricultural journalists in language more communicative to their readers. By this low-cost means the science agency was able to reach the top 20 per cent of primary producers, the innovators and early adopters who set the pace for the others, across the nation. A subsequent survey revealed that four out of five of these farmers had changed their farming methods as a result of advice gleaned from articles in the magazine. A parallel case in a developing country was the use of radio interviews with local sugarcane growers describing their experiences in trying to adopt and adapt new farming systems and technologies. Likewise, in Australia, a marine management agency used videotaped interviews with fishers describing their experiences to raise awareness of technologies for more sustainable fishing practices. These were distributed to every boat in the fleet, and could be watched as the crews sailed to and from the fishing grounds. The growth in use by primary producers of the web, multimedia and digital video disc technology are greatly increasing the power, scope and interactivity of these methods.

While the science agency can pick and choose among the various methods and technologies for delivering its knowledge, the use of a real farmer, forester or fisher as the messenger is likely to remain a constant ingredient in success.

The rules for preparing a communication plan aimed at rural audiences are:

- segment the audience and understand their differing needs;
- make sure the information and messages apply, and can be understood, locally;
- use spokespeople who are credible to a rural audience (rather than to scientists);
- carefully select key messengers based on credibility and respect;
- network with relevant professional, community and interest groups;
- set up the process as a dialogue, an exchange of information, rather than a monologue;
- use the same terminology and language as the rural people speak; and
- be prepared to ‘get mud on your boots’ to find out what local people think and want.

Chapter 6

Communicating with the public

A groundbreaking report by the UK House of Lords Science and Technology Committee in 2000 concluded that 'direct dialogue with the public should move from being an optional add-on to science-based policy-making and to the activities of research organisations and learned institutions, and should become a normal and integral part of the process'.[1]

The report noted a 'crisis of trust' between the public and science, brought on by issues such as Mad Cow Disease, the genetically modified food debate and the pressures for change caused by information technology. It found that the British public had 'much interest, but little trust' in modern science and technology. A number of issues underpin this lack of trust:

- the perceived purpose of the science is crucial to the public response;
- people now question all authority, including scientific authority;
- people place more trust in science that is considered 'independent';
- government, institutional and commercial secrecy are a major issue;
- many scientific issues also embody social, ethical and moral aspects, and excluding these invites hostility;
- what the public finds acceptable often fails to correspond with the objective risks seen by science; and
- underlying public attitudes are people's values. These cannot be challenged or ignored lightly.

Some may argue that these are matters peculiar to Britain, where there has been a series of scandals mostly involving the food supply and agriculture – and where such issues are the staple diet of a lurid tabloid media. But British citizens' caution over genetically modified food, for example, has been widely reflected in societal attitudes in other European countries, in New Zealand and Australia, increasingly in North America and in parts of Asia. Furthermore, impelled by the wavering trust of its public, the British scientific policy establishment has done a great deal of creative thinking about the issues of science and society, the democratisation of science and the engagement of the public in the research process that is well in advance of the debate in most other countries.

The UK's scientific establishment claims to detect 'a new mood for dialogue between the public and science' based upon a very extensive round of opinion research and feedback involving:

- consultations at national level;
- consultations at local level;
- deliberative polling;
- standing consultative panels;
- focus groups;
- citizens' juries;
- consensus conferences;
- stakeholder dialogues;
- internet dialogues; and
- The UK Government's Foresight program.

New mood or not, this is an impressive track record and a milestone in science communication with the public that few other nations have yet contemplated let alone embarked on. In the case of Australia, for example, Irish science communicator Brian Trench made the point that while Australia's premier knowledge society document, *The Chance to Change,* noted that one of the great advantages of investing in science and technology is a 'responsible, informed and responsive society', the document made no suggestion as to how this might be achieved. Although it referred several times to the 'people and culture' dimension of a knowledge economy, it listed nine indicators of knowledge economy performance but omitted any reference to people and culture.[2] It may be unfair to single Australia out for special mention in this context, but it seems just a little strange that a policy document which espoused people and culture as key components of a knowledge economy then made neither proposals nor set progress indicators.

The risk is that, by policy-makers taking a science-centric rather than a society-centric position on the knowledge economy, national plans will be laid that look great to science policy supporters but that leave society cold. In short, it overlooks the fact that a knowledge economy consists of people, and cannot function without them.

We have used the case of Australia because it appears to exemplify a common enough situation round the world, where science and science policy are driven by those in the field and the rest of society is patronised or excluded. For most people this unpleasant experience of alienation from science, the most fascinating of all fields of human knowledge and discovery, begins in the schoolroom. The experience then continues through life, resulting in policies designed to promote science and technology or 'the knowledge society' that somehow never quite seem to work, the main reason being that society has already been disenfranchised. That is when it starts to erect roadblocks in the paths of researchers and innovators. Britain, at least, is starting to address this issue.

Referring to their list of public consultation techniques, the UK Lords conclude that they all have value, help the decision-maker to listen to public values and concerns and give the public some assurance that their views are taken into account, increasing the chance that decisions will find acceptance.

'They are however isolated events, and no substitute for genuine changes in the cultures and constitutions of key decision-making institutions,' the report continues. 'A meaningful response to the need for more and better dialogue between the public and science in the United Kingdom requires us to go beyond event-based initiatives like consensus conferences or citizens' juries'.

Their conclusion is striking: *the very terms of reference and procedures of scientific institutions must be changed, to open them up to external influence and input from diverse sources.*

This, no doubt, produced much choking and spluttering into the common room port, as the Lords hastened to add that their intent was not to limit or restrict science.

> *Nonetheless, in modern democratic conditions, science like any other player in the public arena ignores public attitudes and values at its peril. Our call for increased and integrated dialogue with the public is intended to secure science's 'licence to practise', not to restrict it.*

They then followed up with a firm recommendation for public consultation to become an integral part of doing science – not an optional add-on.

This may seem a bit heretical in lands where science policy is still in the hands of the science mafia, and the game is how to limit and exclude rather than to engage, listen and learn. But there is more than a grain of commonsense in it.

The British Council, in its useful report on the democratisation of science, lists the following essential preconditions:

- openness;
- transparency;
- responsibility and accountability;
- independent advice and research;
- appropriate technological trajectories;
- meaningful dialogues;
- skills and education policy development;
- equality in the distribution of knowledge and technological solutions; and
- initiatives to forecast, recognise and resolve conflict.

Most scientific institutions, if they scored themselves honestly against each of these criteria, would not achieve a distinction, a credit or even a pass for this particular exam.

The rest of this chapter looks at practical ways to build a dialogue with the public, in addition to those methods already discussed for three particular publics – the media, government and industry. It also sets out some of the steps necessary for this to occur.

The institutional charter

Most scientific institutions have a charter, an act of Parliament or some formal instrument that causes them to exist and defines their role and purpose. In the majority of cases this will refer directly to scientific research or discovery, to being a place of 'learning' (which includes the research function, alongside the educational one) and, on occasion, to a duty to 'publish' their findings and discoveries. This latter word is normally interpreted in the narrow sense of publishing in the academic peer-reviewed literature, not necessarily in the wider public domain.

Although these charters prescribe that a representative council or board consisting of worthy citizens oversee the institution, very few lay down requirements for wider consultation and discourse with the public. This is an obvious and critical omission. A scientific institution that is not committed by its charter or Act to public dialogue risks becoming an anachronism in the 21st century – the century of the sharing of human knowledge.

The same applies to scientific programs initiated by legislation or regulation. Under democratic principles they, too, ought to have consultation and public discourse built-in. While some may argue this to be excessively coercive, the experience of the past 100 years shows that, while science can plainly see a problem in its ability to communicate with society, it hasn't been able to solve it. Perhaps it is time to try firmer measures.

Policy bodies

The obligation to hold dialogue with the community should become a major function and activity of science policy organisations, such as Government bodies or Academies, instead of an adjunct to what they presently do.

Best practice

Within the spectrum of scientific institutions, universities and policy bodies resides enormous, but very varied, experience in ways to communicate more effectively with society and elements of it. The pooling and sharing of this experience, and the creation of national best-practice guidelines for various communication activities is desirable. This will save institutions from having constantly to 'reinvent the wheel' (and save a lot of time wasted on re-strategising).

International leadership

There is something of a vacuum in international leadership in the field of science communication and public dialogue and consultation. Given the absolute importance of the sharing of knowledge between the haves to the have-nots in this century, it can be seen that much esteem awaits the nation or institution able to demonstrate global best practice, set standards and encourage others to follow suit.

Funding agencies

Bodies responsible for funding research, especially from the public domain, have a particular interest in ensuring that the benefits flow efficiently to society. Not only can they help to achieve this by adopting a higher level of commitment to openness, consultation and dialogue with the public themselves, but they can also powerfully influence the attitude of individual researchers by making communication and dialogue mandatory for every grant recipient. It is our view that until this rather simple step is taken there will not be a sufficiently sharp stimulus within the scientific community to change its culture from being closed to consultative.

Industry bodies and councils

These also have a strong interest in having a public, or consumers, who are engaged, enthusiastic and responsive to new technologies and processes, rather than mistrustful and suspicious. They too can send influential messages to the research community that public dialogue leads to more successful research outcomes – and to less waste of research funds and time. With science now so highly geared to the needs of industry, views such as this from industry will be extremely positive in securing cultural change in science and reduced levels of suspicion and mistrust in the community. This in turn benefits industry.

Professional science associations

The associations and institutes that represent physicists, chemists, biologists, earth scientists and all the various tribes of researchers are the guardians of professional ethics, standards and practices for their members. Many of them already place a reasonably high priority on communicating, although this is generally from the narrow view of wishing to recruit more bright young people into the profession or garner greater public recognition and respect. There is an enormous opportunity for professional associations to articulate the importance of their members holding dialogue with the public, and so become a powerful force for changing research cultures. In any enlightened body this will be high in their professional code.

Government agencies

Government bodies responsible for standards, safety and other technical and regulatory matters have a very high responsibility for preserving public confidence in science and technology, and in the ability of government to regulate them successfully. Being composed chiefly of technical people and bureaucrats, they have tended to rely more on the aegis of their authority rather than effective dialogue and communication aimed at greater public understanding and support. This is changing rapidly, with more and more of these agencies acknowledging that public confidence is better obtained through dialogue than an overbearing assertion of technical expertise. Their communication skills, not in general very high, are at least improving. A recent setback has been the excessive emphasis on corporate and government stakeholders in framing overall strategy. While commendable, this also has the downside of de-emphasising communication with the public, and may leave the agency so focused on the needs of, say, a big government department which is its primary source of funds that it neglects its relationship with the wider community.

Communication methods

The following communication methods are effective for engaging the public in a dialogue about science and technology issues and developments, and sharing meaning.

- **National and local consultations** can be set up in which government or scientific organisations deliberately create fora for the public and scientists to interact on particular issues of interest and concern and then advertise the fora, call for submissions and encourage the media to cover them.
- **Citizens' advisory panels** explore particular issues and aspects of science or scientific institutions. There are two possible approaches, the first being to use well-known and highly-regarded citizens who are not connected with the science, such as prominent lawyers, philosophers, artists and even sports stars in whose general integrity the public has high confidence. The second is for the panel to consist of the nominated representatives of particular citizens groups and non-government bodies, such as consumer associations. This version is somewhat more politicised but has the advantage of bringing critics inside the tent. The panel can be either standing or convened for a single task, although the former is more likely to gain public recognition and trust.
- **Lay members of science committees** can provide particularly valuable advice about how society is liable to receive or react to new developments. Because of their wide contacts across a spectrum of the community, journalists make useful members, as do sociologists, psychologists, philosophers, former politicians, science communicators, and consumer and environmental advocates.
- **The web** provides an interactive way to communicate with the public but, in practice, is generally used as an 'information dump' on the unsuspecting user and this can be counterproductive. Despite its vogue with scientific and government institutions it suffers the major drawback of being inaccessible to very large groups in the population, including the elderly, the poor and lower socio-economic groups, the vision-impaired, the illiterate and all those who simply have no access to computers – the vast majority in both developed and developing countries. It also contains an ocean of absolute garbage whose presence may devalue serious messages in the eyes of users. However, chat-

rooms and sites where the public can gain immediate responses from experts to their questions are nevertheless one of its attractive features, as is its ability to signpost other sites of interest and relevance – including opposing viewpoints.

- **Public opinion research**, both quantitative and qualitative, can provide very effective and up-to-date snapshots of what the public, or segments of it, knows and thinks about science and technology issues. Details are in Chapter 12.
- **Media analysis** and **journalists' workshops** are a valuable two-way mechanism for understanding perspectives on new technology as they are put to the public by the media, the media's views on it, and their impressions of their own audience's opinions about it.
- **Consensus conferences** and **citizens' juries** are where a representative group of citizens and selected experts from science, industry and government meet to discuss an issue in depth over several days, and produce a consensus report covering all those points on which they can agree and noting where they dissent. While uncomfortable for science and industry, these help them to understand far more clearly what they are dealing with regarding public attitudes. These conferences can be broadcast and covered by the media, thus enlarging their audience reach into the community, and public feedback can be built-in. Citizens' juries are similar, but instead of citizens and experts negotiating a consensus position, the citizens simply deliver a verdict. This may, of course, lead to further polarisation of views.
- **Foresight projects** are where science and technology experts project various futures arising out of present-day knowledge and technological trends and expose them to feedback from various public, industry or government audiences, and then publish a summary of the views.
- **Industry seminars** are an important way for science and industry to come together to plan the best ways of introducing a new technology. They are generally of greater value where they include representative views from the community.
- **Newsletters** are useful in communicating between organisations and with the media, rather than with the public. The key to success in newsletters is to provide readers with material that is exclusive, informative and useful. Not all meet these criteria. Feedback should always be encouraged and published.
- **Labelling** of food and other consumer products is a vital way to convey objective information about health, safety and environmental aspects of technology. However, it is rapidly becoming so technical that

it is meaningful only to a very few – and this alone is alienating to many people. Every effort should be made to keep it simple and relevant, avoid jargon and encourage feedback. An important step is the use of citizens' advisory panels to help decide what should and shouldn't go on labels, and how it ought to be explained.

- **Radio** and **video** are valuable means of communication in areas where literacy levels may be low, provided the people can receive them. The most effective technique is to present discussion about technology involving consumers or users who are typical of the local community, including points both for and against it. Where possible, radio talkback can be used to engender discussion in the community. Even though some callers may seem mindlessly critical, they nevertheless give vent to community feelings and frustrations, and that permits people to feel their views are at least being registered. Science should not fear talkback, but be patient and constructive.
- **Open days** and **open laboratories**, where the public can stroll through and observe the scientists at work, are a useful way of demystifying research, especially if there is an opportunity to ask questions and exchange views.
- **Specialist media** such as farming papers, hobby magazines, and professional and industry journals are ideal for carrying in-depth articles exploring the various aspects of a new technology, and discussing the pros and cons. A good tip is for the editor to call for reader letters on the subject, to be printed in the next issue. Scientists and regulators can then respond to points raised in the letters, and so a dialogue is created.
- **Shopping centre displays** are especially effective if there is interactivity in the form of a knowledgeable communicator to answer questions and interactive computer programs. There must also be a suggestion box or means for the public to record its views and feelings.
- **Museums, science centres, galleries** and the like present an excellent opportunity to reach the public as they have done for more than 150 years. Modern museum philosophy calls for a much higher level of interactivity, 'hands on' experiences and direct engagement with the public than the 'glass case' mode of earlier times. It is important that exhibits be designed as 'road shows' capable of being transported around the countryside, and not confined to a single venue if possible. Ideally they should also include public seminars where open discussion of science can take place. For visitors, dialogue and feedback to science should be part of the 'museum experience', not merely the passive reception of information.

- **Science circuses and drama** are an animated and friendly way to present scientific concepts to children and young students, although here again care must be taken to build in room for interaction.
- **Teacher conferences.** It is sometimes said that teachers who hated science when they were at school are responsible for a lot of the negative messages received in the classroom today. True or not, there is sense in seeing that teachers – especially teachers of sociology, social history, general studies and the like – are better acquainted with modern science and technology, and have a chance to explore the issues around it. Like other groups, it is important to satisfy both their need for information and to heed their views and values. Teachers are inundated with advocacy literature from various industries and groups. It is more effective to run a forum at their conference than to hit them with an 'information dump' they may regard as propaganda.
- **Politicians**. Chapter 4 referred to the use of politicians as messengers and feedback-providers for science. Few people are so acutely attuned to nuances in community opinion as politicians, and the well-briefed MP can be valuable for facilitating public discourse around science and technology.
- **Religious institutions** are highly engaged in the community's moral and ethical values, as well as issues such as equity, health, safety and the like. They can play an extremely valuable role in facilitating dialogue between science and the community, sharing knowledge and meaning.
- **Non-government organisations** usually have a barrow to push, sometimes negative so far as science is concerned. However, they are an important way for science to tune into the articulate concerned in the community – environmental opinion, for example – and should be included in the process of discussion by scientists, not shunned. It will also surprise (and hurt) scientists to learn that the more famous advocacy groups enjoy a higher credibility with the community than do most scientific institutions. This is due to a perception that they are on the side of the public good, whereas science is perceived to be slipping into the corner of private interest.
- **TV chat shows**. Some scientists might reel with horror, but these too – in spite of a heavy entertainment bias – are a forum for society to dissect and debate new ideas. All that is necessary is for science to accept that its job, in this special context, is to be entertaining. They are useful as a testing ground for ideas because if you can't make it fly there, chances are you will have problems in the wider community. They have the added advantage of a big audience.

- **Taxi drivers.** Some of them have degrees these days, or are studying for them! Taxi drivers are usually ready for a debate about current social issues. They are a good way to take the temperature of community opinion and identify some of the issues you may wish to pursue in more formal opinion research.

Scientific publication

An issue that remains unresolved is whether scientists are under a duty to inform the public of research findings highly important to the public interest *before* they are subject to peer review and journal publication. Many scientists would say: 'Of course nothing must be released until it has been reviewed'. However, the public and media, if they find out that important information has been withheld from them to satisfy what may seem to them a professional nicety, are liable to cry 'Cover up!' and adherence to strict scientific convention may become a griddle for the institution to be roasted on. The value of having an external advisor is clearly to be seen here, because he or she can assist the researchers to understand better how their finding (and themselves) will be viewed by the public, and what is the best course to take.

The second, but equally important issue, is whether public disclosure should await publication in a scientific journal – something that more and more journals insist on, blackmailing their correspondents with threats to deny publication if anything leaks out. This practice, which is based largely on the commercial desire of journals to be 'first with the news' for their subscribers, runs counter to the public interest. It is morally hard to justify keeping society in ignorance of some important new fact or insight merely to gratify the publisher of a limited-circulation publication – and smart journals will not insist on it. Instead they will actually help their correspondents to make the essential news public, promising full details in their forthcoming issue and thus earning themselves a name for social responsibility while promoting their publication to a far wider audience.

A statutory science communication body?

Countries sometimes debate the need for a national science awareness or communication entity to oversee and help to improve the standard of dialogue between the research world and the rest of the community.

In our view a statutory body is only desirable to the extent that it obliges the scientific and science policy world to take the issue of science communication as seriously as it does the issues of discovery and invention, and to recognise that it needs to lend it equal weight and emphasis in policy.

A statutory science communication agency could help by providing best-practice models to scientific institutions to harmonise the culture of communicativeness in science – but this job can be done just as readily by existing entities such as government science departments or academies. The last thing communication should cause is the formation of fresh layers of bureaucracy.

Finally, it is not by any means clear that the public would repose trust in a government-owned science communication body – and might even tend to regard it as a professional spin-doctor for science. Nor is it clear that individual science institutes and associations would cooperate fully with it.

Overall, a national science communication advisory council seems a sounder way to go, provided it has influential and active connections to the key scientific institutions, universities, funding agencies, academies and policy bodies, and is not dominated by academics but consists substantially of communication professionals and representative citizens. Even then, its role will be limited to advice, guidance and best practice – to influencing rather than regulating or enforcing.

When all's said, the best people to communicate science to the public are the scientists who do it themselves, with all the assistance they can get from their institutions, their professional science communicators, their governments and industry partners and, especially, from the public itself. Scientists have the priceless quality of enthusiasm for their subject, a little of which goes a long way in the communication game.

Chapter 7

Talking to the world

In the 1980s, a Swedish futurologist named Åke Andersson described the emergence of a society in which minds were webbed together along great axes of intellectual development and high technology, extending from city to city across national borders and around the globe. Along these axes thoughts, ideas, discoveries, collaboration and creativity flowed freely as the world's best minds were networked together using communications at the speed of light. Beyond the axes, however, were great hinterlands of darkness, places were knowledge, enlightenment and high-tech facilities did not reach, or penetrated only in a spasmodic fashion.

His description triggered a recollection in one of the authors: it was an interview with a neurological scientist some months earlier. We had discussed the processes of the formation of the brain in a human embryo – the eerie process by which axons, glions and neurons link into filaments, send out tendrils and begin to transmit messages back and forth. Finally, as the network branches throughout brain and body, at some indefinable moment in the pregnancy a capacity for cognate thought is born. The embryo becomes a person capable of sensation, feeling, dream, thought and imagination.

The idea grew that the gradual linking of the world's best minds at the speed of light, described by Andersson, might perhaps be seen as the early stage of a vast act of cognition performed by thousands or even millions of human minds now joined together (almost) in real time. Humans have, of course, thought collectively as well as individually for many thousands of years but never before on such a scale, so fast or so globally. It is as if an enormous planet-sized mind is in the process of formation, if that is not too Gaian a conception. Setting aside the more profound implications, such a mind ought, at the least, to be able to move thoughts, ideas and knowledge along its neural pathways in ways never before imagined, and share them more effectively with the outer tendrils as well as the nodes.

One thing is certain: developments in information and communication technology create the possibility for more effective global sharing of knowledge than ever before. The issue of the 21st century is whether this is used to benefit the wealthy few or the many; whether the brain exists to serve the whole body, or simply itself.

Scientific research institutions have never previously had such an opportunity to share their discoveries, achievements and findings with people all around the world, so easily, so rapidly and at such a low cost. For them, effective communication has never been so urgent, nor so vital.

The most affordable techniques involve the world media and the web, which are becoming pervasive. Even in those countries and regions not yet 'wired' for internet services, satellite television and radio as well as newspapers are penetrating widely. Furthermore, knowledge is increasingly reaching remote regions through education and extension services, as well as commerce. The challenge for scientific institutions is to find low-cost, effective ways to disseminate their knowledge through these delivery mechanisms – and to garner the societal feedback that will ensure their output is in tune with the needs of recipients.

Global media

The global media is presently the most powerful tool for the transfer and sharing of human knowledge. In advanced societies, most adults gain their knowledge and understanding of new discoveries and technologies from the media. In many developing countries, too, it is the primary source of new ideas. Although educators might not see it quite that way, the media is already providing societies with lifelong learning. Its golden quality, from a communication perspective, is that it allows discussion and debate to flow in both directions. It is pleased to carry scientific ideas to the community, but equally concerned to carry the community's reaction and opinions back to the scientists. The outcome is a better fit between science and society.

For a scientific institution to access the global media is not difficult, but does require some expertise and commitment of staff and time. For this reason, few attempt it. Yet having a global reputation is one thing that can assure the longevity of a research organisation and its funding in the global century.

There are good reasons to develop an international media presence:

- to share knowledge more effectively with a greater proportion of humanity;

- to alert other scientists around the world to the work of the institution, leading to useful partnerships and collaborations;
- to attract investment in research from both public and private sources, and to greatly enlarge access to global venture capital;
- to build the international profile of the organisation as a means of attracting the best and the brightest research staff;
- to build the reputation of the organisation as a means of achieving more widespread adoption of its research outcomes;
- to enhance its own world outlook and shape its research to global needs; and
- to contribute productively to global thought, debate and policy development on pressing issues.

Given these advantages, it is rather remarkable how few scientific bodies look beyond their local and national opportunities, both for awareness and for investment. It is equally remarkable how often those who are seeking to build an international profile do so by employing commercial image-mongers, rather than by communicating their genuine worth to humanity and their real achievements as researchers.

Leading media

The most effective method for communicating the value of a scientific research organisation to the global community is to deliver factual accounts of its discoveries and achievements to specialist science and technology journalists from the world's leading media.

This is not so difficult a task as might be imagined, as most countries have one or two media – usually quality national newspapers or national broadcasters – that dictate the news trend for most of the other media in their country, and are closely followed by them and by decision-makers.

All that is necessary is to contact each of these 200–300 leading papers or broadcasters, ascertain the names and email addresses of their key science, health or environment correspondents, and then seek their permission to deliver appropriate science stories to them. Most correspondents are keen to receive good quality science stories from other countries in order to remain in touch with global developments in their field. They may only actually use a small proportion, and this will depend on the news value of the story in their country and at the time of writing. However, the returns from such coverage can be impressive in the form of new investment in research, new partners and customers, and wider international recognition and stature.

An up-to-date email list of the world's leading scientific correspondents is a pearl beyond price for the science organisation with a global perspective and international ambitions. Needless to add, regular work must be put in to ensure the list remains current.

Email notification

To avoid annoying science journalists (and others) with lots of long stories that clog their email system, a highly successful alternative is to use an email notification service. This simply informs them of the release of a new story and its headline. If the topic interests them, they click the title to go through to a web page with the full story on it accompanied by pictures and graphics.

This requires some skill in crafting the headline so that the subject of the media release is quite clear from it. However, it allows journalists to select what they read, without irritating them by overloading them with information not relevant to their interest or specialty. They can subscribe or unsubscribe at will.

International news agencies and networks

An effective way to reach leading national and global media, as well as others, is through international news services such as United Press International (UPI), Associated Press (AP), Reuters, Australian Associated Press (AAP), Agence France Presse, AGI (Italy), Novosti (Russia), China News Service, Interfax, ANTARA (Indonesia), BERNAMA (Malaysia), Deutsche Presse, Panafrican News Agency, BBC News, FOX News, CBS, CNN and so on.

A news story delivered to these agencies will be distributed widely to international, national and local media as well as the business media, and will often be reproduced as a news agency report on the world news or business pages when their in-house science writer is otherwise occupied.

Some agencies offer a media release delivery service in which they charge for the distribution of releases to other media outlets, but in our experience the cost of this is high, the precision of delivery low and the timeliness inexact, compared with the science institution maintaining its own distribution system and database of target audiences and categories.

The web

The web offers excellent opportunities to communicate new scientific discoveries and advances, particularly to specialised science writers but also to a general audience.

A number of science websites specialise in reporting the latest scientific news to their audiences. These are frequently visited by science journalists, students, industry research managers and others interested in remaining in touch with the advances in knowledge.

Some publish science stories free of charge, while others levy a fee or subscription to post a media release on their website. A third category operates as electronic news services, and do their own reports based on material received. As a rule of thumb, use all the sites that are free, and pay for publication only on those others that can demonstrate an influential audience in the target group(s) sought by the institution. Here, mere numbers of daily 'hits' are not enough: ask to see evidence of the 'quality' of the clientele.

The main goal of web distribution is not to attract passing traffic (although that is a bonus), but rather to use the web as a conduit for reaching the mass media, which will multiply your 'hits' by millions and also reach the 'non-wired' or those 'too busy to surf'.

To enhance your prospects of publication on the web, especially on news sites, the quality of pictures accompanying the story is a vital attribute. It is desirable that every story sent out is accompanied by several digitised images in both large and small formats, both pictures and graphics where possible.

Electronic newspapers

An increasingly important target for distribution of science news are the electronic editions of famous newspapers and broadcast news services published on the web, such as the UK *Telegraph*, *Times* and *Guardian*, the *Washington Post*, *LA Times* and *New York Times*, *Frankfurter Allgemeine*, *The Australian*, *Le Monde*, *Pravda*, *La Repubblica*, *Jerusalem Post*, *The Star*, *Straits Times*, *O Globo*, *New Zealand Herald*, *Jakarta Post*, *Times of India*, *People's Daily*, and the BBC, ABC, CNN and the like.

Although, technically, the electronic newspapers reflect the content of their newsprint big brothers, their editors are quickly discovering that the electronic audience is not quite the same as the paper audience. It has different standards of technological literacy, for example, is more adept at searching for and locating information in the electronic medium, and has a higher interest in technical and scientific issues. This means, in practice, that many electronic editors are seeking to subtly distinguish their product from the paper edition and may be more receptive to stories about science and technology. There are also nuances in writing for the web that distinguish it from writing for traditional media like newsprint, TV and radio.

For this reason it is worthwhile for a scientific institution with a good story to send copies of the announcement separately to both the parent newspaper (science writer and news desk) and to the news desk of the electronic edition. It may appear in one but not the other, and it is good practice to hedge one's bets. Most electronic newspapers give their email address for delivery of media statements on their websites.

CDs, DVDs and electronic cards

These are all useful ways to convey detailed information in multimedia format. However, they depend on the recipient having the time and patience to browse the contents. As for other media, the rule is to make sure you understand your customers' information requirements and reading habits before you invest a lot of time in creating trendy electronic publications.

Quite useful are plastic business cards with CD memory that provide a basic background on the organisation, its achievements, capabilities, services and contact details. The card can be hooked to the internet to provide greater depth of information to the user. An advantage is that the information can be edited and presented according to the needs of the individual whose name is on the card, or the particular client.

Cable TV

Cable and satellite TV services with a focus on news, science, discovery, business and current affairs appear to have an almost insatiable appetite for well-made TV science stories to stock their magazine programs and news bulletins, and to use as fillers.

Their requirements vary, but most in demand are items of 3–5 minutes length, produced in international TV formats on betacam tape and with the capacity for the voiceover to be dubbed in different languages. As described at the end of Chapter 3, it is important to emulate TV news style with brisk, stimulating plain-language reporting that carefully avoids the slightest suggestion of 'PR', but instead adopts an objective journalistic tone and is accompanied by interesting vision.

Many cable TV companies will broadcast material that meets their production standards free of charge. A great advantage of using cable TV is repetition – the same item may be screened several times, at different times of the night and day, over weeks or even months.

Some cable companies will seek to charge scientific institutions to broadcast their material, which can be expensive. It is highly advisable to do careful research into the viewing audience profile in order to determine if this is a good investment.

The organisational website

This book hardly needs to add to the reams that have been written about how to design a website. However, it should be noted that the mistake most commonly made by scientific institutions equipped with leading-edge computer technology is to assume that all their audiences are likewise equipped – and to create a site overloaded with images and gimmickry that is appalling slow to load on a slightly antiquated machine using a typical suburban connection and an overtaxed internet service provider.

The following are some ground rules for using the website to share knowledge more effectively.

- Great websites are based on sound communication principles and planning. 'Look' comes second.
- DON'T promote the organisation; promote the scientific achievements.
- Avoid bright colours and flashy layouts that may detract from scientific credibility.
- Use images, but keep them to thumbnails or low resolution pictures (about 3–5 kb). AVOID large and high resolution pictures, complex multi-image graphics, animated devices, music, movies etc.
- Run the latest news stories prominently on the opening page, remembering that constant variety and change are the secret of generating regular traffic to the site.
- Ensure search engines are capable of using not only scientific but also lay terminology, so the public can use them easily. Include a search by industry or profession function.
- Provide plain-language definitions of scientific terms used on the website, as scientists sometimes employ the same word differently in different disciplines.
- Give very careful thought to the meta-data that will attract people using search engines to your website. The choice of key words can be critical. Ideally they should be terms in common usage that describe the scientific work of the organisation (unless the intent is to restrict visitors to specialists).
- Always provide contact points for further information.

- Provide easy access buttons for different categories of visitor, behind which they can find specialised help and contacts (e.g. buttons for industry, students, the public and research partners).
- Update the site constantly with new images and news items– a dated site is a dead site.
- Avoid a 'blank front door' or generic opening page that forces visitors to click through several screens before getting to the information they want.
- Offer a notification service to inform visitors by email when new items are posted on the site, thus encouraging them to visit regularly.
- Classify scientific information in lay terms (e.g. industry sector or societal issue) rather than by scientific discipline, remembering that many people do not know what coprology or bioinformatics are.
- Provide 'layered' information, with plain-language summaries on top followed by more specialist information for particular audiences (e.g. industry) and finally hard science.
- Provide a 'dial-an-expert' database to help industry and the public locate the appropriate scientific expert quickly and without multiple calls. Organisations that do this are rapidly stealing a march on bodies that still try to shield their staff against the outside world.
- Provide lots of signposts to partners, industry clients, government and non-government organisation websites. Be helpful to visitors seeking a broad range of information on a topic and you will become a regular internet 'crossroads' for them.
- Provide an email/phone inquiry handling service to refer queries to the right expert or area of research if they are unsure what advice they need.
- Offer dial-a-scientist services, chat-rooms, visitors' books and other outlets for public comment, feedback and questioning.
- Use the website to poll various audiences for opinion and feedback.

Free feature services

A very promising technique, in an age of cost-conscious media, is to provide a website containing professionally written feature articles on your science, offered free of charge. A surprisingly large number of these are picked up and run by regional, national and international media, many of whom are facing budget problems in their ability to pay for external work. It must be noted that, in principle, for an organisation to provide a pre-written article conflicts with journalistic ethics. However, if great care is taken to ensure that the article is objective, unbiased and written by a professional freelance journalist with an established name and track record, this difficulty can be avoided. However, it means that the science organisation must adopt a 'hands off' stance with regard to the content and style of the article, which is the province of the journalist and the editor who accepts it for publication.

The key tenets of a 'free feature' service are:

- articles should be written by professional freelance journalists, and be scrupulously objective, not organisational PR;
- they should be accompanied by quality colour images in a range of sizes or resolutions, and including photos and graphics;
- the site should be refreshed with new features regularly to encourage editors to visit it; and
- notify editors by fax or email whenever new articles are put up.

'Op/eds'

Media are also grateful to receive opinion articles written by (or ghosted for) eminent scientists contributing to public debate on topical issues. These are a good way for the scientific institution to signal its engagement in world issues.

It is desirable to have a journalist ghost-write or edit the scientist's opinion piece, as few scientists are masters of the exacting art of opinion writing. The essential element is brevity – most 'op/eds' are between 500 and 1500 words in length, and often have a strict maximum. Structure is also critical, and the scientific writing approach is not suitable.

A good op/ed opens with a strong expression of personal opinion, not a rehearsal of historical facts. It is crisp, punchy and provocative. Its aim is to stir readers into response, for or against, rather than recite a lot of data or educate the reader.

It is an excellent way for a scientific body to 'test the water' of popular opinion if it is working in a controversial field. When targeted at global media, it is also a way to project the scientific institution's capabilities and identity to a world audience.

Diplomats and embassies

Almost all embassies, and many consulates, have an official whose job is to monitor and report on scientific and technological developments in the country to which they are posted. He or she will usually be designated as the scientific attaché.

These officials provide an effective route for conveying news of scientific discoveries and advances to foreign governments, who will frequently disseminate it to their own scientific institutions, industry and potential partners and to various community groups. The result can be greatly increased opportunities for international scientific collaboration, overseas investment, commercialisation and adoption. It makes sense to include these diplomatic officials in the distribution of science news announcements and reports, and to include all local embassies on your fax/email circulation.

Another way that diplomats can assist the process of sharing knowledge is to channel science news to your own country's overseas embassies and diplomats. This provides your foreign representatives with up-to-date news and information they can share with their contacts in foreign universities, industry, research agencies and government. The best method for delivering this information is by email, or by means of an email notification service (described above).

Alumni associations

As universities internationalise, offering courses offshore and attracting foreign students to their home campuses, there is great potential to use the overseas alumni network as a way of sharing knowledge and reaching new science partners and investors.

Alumni networks often contain people who, as a result of their overseas education, have become highly influential in business or government, yet who still cherish an affection for their former university, scientific agency or the country in which they studied.

Alumni can be kept up to date with the latest scientific advances by means of an email notification service (described above) that alerts them to new announcements, developments, conferences etc. and does not clog their email like a detailed electronic newsletter. However, it is a good idea to include a brief summary of these announcements in the regular newsletter. They can subscribe or unsubscribe to the email notices with ease.

Professional associations

There is a number of professional networks whose members can help to disseminate a science story internationally. They include bodies such as the international conference for the Public Communication of Science and Technology (PCST), science writers and broadcasters' organisations in many countries, the Profnet university information officers association and International Association of Business Communicators (IABC).

International ambassadors

An effective technique for drawing global attention to important scientific issues and developments is the use of world-famous 'ambassadors'. These should preferably come from a field or profession unrelated to science so that the focus of news attention is on why they have chosen to associate themselves with this particular issue: the curiosity factor.

An ambassador could be a well-known head-of-state, a famous sports hero or media identity, a musician or rock star, an eminent academic or religious leader – any person who can bring attention and credibility to the issue of concern.

A successful example of this technique is the *Future Harvest* campaign developed by the Consultative Group on International Agricultural Research (CGIAR) to promote global awareness of the importance of international agricultural science and to reverse a decline in investment resulting from apathy about the world food situation.[1]

The campaign recognised at the outset that most people outside the profession of agricultural science find it of limited interest, and do not readily perceive its importance to their own lives – especially if they live in big cities and in developed countries. The goal was to build a wider community of support and understanding for research into sustainable food production in the developing world.

The campaign was built around five 'pillars', each directly affecting the lives of every person on the planet, every voter, every politician:

- **Food for Peace** demonstrates the linkage between agricultural failure, misgovernment and conflict;
- **Food for Growth** demonstrates the linkage between agricultural success, economic growth and stable government;
- **Food for the Earth** promotes sustainable agriculture as the solution to many of the earth's large-scale environmental problems;
- **Food for Health** promotes agriculture as the basis of improved nutrition to overcome the most common forms of death worldwide; and
- **Food for People** promotes the idea that agricultural prosperity helps bring about lower birth rates in rural areas.

The campaign addresses what is perhaps the overwhelming issue of the human destiny in the 21st century:

> *A quiet crisis faces our global community. We must feed the world while preserving our fragile environment. Political instability, population growth, climate fluctuations, poverty, and stagnating food yields threaten our ability to do this. Hunger-driven conflicts, malnutrition, mass human migration, shortages of water and arable land, and a failing environment seem remote to many people, but they are certain to occur.*

Future Harvest is a wake-up call. It focuses global attention on these issues in order to find solutions. It works to promote awareness and educate the general public and decision-makers about the importance of food production and the role of agricultural science in meeting the human and environmental challenges of today and tomorrow, and build financial support for scientific research and charitable projects that bring the results of this research to rural communities, farmers, and their families in the developing countries.

To carry out its work, *Future Harvest* commissions highly respected experts to explore the links between food and agriculture and important universal issues including environmental renewal, peace, economic growth, health, and population concerns. It enlists influential public figures, world leaders, Nobel laureates, media personalities and entertainers as advocates for world agricultural research. It engages in a range of partnerships to communicate its messages, build financial support, and promote action that addresses global food and environmental challenges.

Among its 'ambassadors' are former US President Jimmy Carter, South African Archbishop Desmond Tutu, Nobel laureates Peter Doherty, Oscare Arias and Norman Borlaug, movie star Jane Fonda, Grameen bank developer Muhammad Yunus, Queen Noor of Jordan, Francine Cousteau and rock group Hootie and the Blowfish.

The messages they deliver to the world media and both global and international decision-makers are based on the five pillars, and argued credibly by organisations such as the Oslo Peace Research Institute and the World Conservation Union (IUCN).

The case put forward by these eminent people is backed up by the scientists working at the world's international agricultural research centres, whose research achievements and views on vital global issues are constantly being put before the world community through the media, demonstrate the value of investing in agricultural research.

Future Harvest is a model public awareness campaign in that it achieves global attention at very low cost through well-thought-out and credible messages, and highly visible and respected messengers, backed by real scientific achievements.

Its basic principles are capable of being adopted by any scientific institution anxious to raise awareness at the global, national, industry or local level.

Chapter 8

Communicating new technologies

The first time the public caught sight of the motor car, they didn't much care for what they saw at all: a noisy, blasphemous object that transported people without visible means of propulsion at the appalling speed of seven or eight miles to the hour, frightening horses and threatening to leave a trail of squashed poultry in its wake. So, in Britain, they insisted that a man with a red flag walk before it to warn all innocent road users and bystanders of its imminence, and to restrict the monster to a sedate four miles per hour until society had had a good, long look at it. This was a perfectly reasonable reaction in the circumstances.

Many's the time humanity has responded with caution to the advent of a new technology. Innocent innovations such as pasteurisation and margarine were originally protested on the grounds that they represented attempts to vitiate the food supply and starve the lower orders. The Luddites took a famous dislike to early factory equipment (which subsequent industrial history might appear to have vindicated). Australians conceived an initial distaste for food irradiation that they still haven't got over. One can even imagine those early pre-humans, crouched round the bloke chipping out the first quartz tools on the Shungura formation in Ethiopia 2.2 million years ago, pointing out that he could easily cut his fingers on those nasty, sharp bits of stone – and shouldn't one just use bits of wood and rock picked up off the ground and shaped as the relevant deity intended them?

Those early toolmakers are quite important to an understanding of societal reaction to new technologies – even though they probably couldn't actually talk, had little in the way of abstract thought, and would be less welcome at your dinner table than a well-mannered chimpanzee. However, by about 1.7 million years ago they had figured out how to use fire to make their meat more digestible (and biologically safer); by three-quarters of a million years ago they were building recognisable boats and going on short ocean cruises between islands; and, not long after, they were constructing cave residences out of timber and animal hides complete with fireplaces. All this occurred at least half a million years before *Homo sapiens* darkened the evolutionary doorstep. One of the things that they were very good at, and becoming increasingly more adroit, was avoiding death by unpleasant means. The social mechanism for anticipating and avoiding danger has played an essential role in our emergence as a species.

Scientists and innovators sometimes complain about human risk aversion, our conservatism and unpreparedness to try new things. Yet it has stood by us for more than four million years since we waved goodbye to our cousins *Pan* and speciated out in quite a different direction. We are remarkably good at adopting and adapting, but at the same time we have learned to be extremely cautious. We know from immemorial experience that new things are not always good things, and even good things bring bad things with them. The canon of popular fiction fulfils the public belief that, even though the intentions of the researcher may be good, the tinkering with the natural order produces calamity. Dr Faustus, Dr Frankenstein, Dr Jekyll and Dr Strangelove are the yardstick by which their real-life counterparts are frequently (mis)judged.

In Chapter 3 we briefly explored the media's apparently macabre obsession with 'bad news' – the crashes, smashes, flood, fires, food scares, pollution scandals, eco-disasters, crime rates, safety fears and other grim events that comprise the daily news diet. The media covers these things mainly because it recognises an insatiable market demand from its readers and audiences for them, and because the media knows that an unrelieved diet of 'good news' will simply provoke skepticism among its consumers. Life just isn't like that, the society tells the editor through the sales figures or ratings. The obsession with bad news and danger is what keeps humans on their toes, their survival instincts sharp, and their scientists productively employed figuring out ways to make the world a healthier and a safer place (and, incidentally, cleaning up the adverse consequences of previous great technological advances).

In this chapter on communicating new technologies, a major contention is:

> *One of the keys to scientific and technological advancement is to engage both facets of the human character – the innately adventurous and the innately cautious.*

Recent efforts to deal with this go by the jargon term 'risk communication'. However, because so many technologists, bureaucrats and industrialists are prone to interpret this as 'making the public understand that the risks aren't really as great as they fear' (a completely wrong-headed view), it is preferable simply to stick with the term communication, defined as a two-sided conversation and an exchange of knowledge. Any delusion that it is possible to force on the public a belief that something is safe or wholesome, contrary to their suspicions, is liable to have counterproductive effects, if not to backfire spectacularly.

One reason scientists are not always trusted by the community is their inclination to put the most optimistic interpretation on their work. If you believed all the public utterances of scientific institutions you would be convinced that science only disgorges an unrelieved fount of blessings. Of course, we all like the world to think well of ourselves and of our work, but practical experience has taught society that most technological 'improvements' have downsides as well as upsides. Didn't all that innocent inquiry into what the universe was made of also result in the atom bomb? It may come as a blow to researchers to realise that the public is as skeptical about scientists in some respects as they are about politicians: the general view is that the proof is in the pudding, not in the promise.

Chemists are occasionally heard to protest that Rachel Carson's doom-laden predictions of chemical catastrophe in *The Silent Spring* have proven greatly exaggerated, and if the world just had a little more chemistry it would appreciate what wonderful things chemicals really are. This, however, is a view that ignores human experience over millions of years since we first learned to avoid the red berries because they were lethal and the serpent for its fangs. Then we learned to dose Socrates on hemlock, to despise Lucretia Borgia and Dr Crippen for using chemicals to do away with people, and heavy industry for its misdeeds at Minamata, Serveso and Bhopal. Society is understandably restrained in its enthusiasm for poisons and poisoners. Chemists don't always appreciate this, preferring to look on the bright side.

However, this is one of the main reasons why the modern community is so intensely cautious, suspicious and untrusting when it finds new things in its food supply, untoward effects in its medicines or environment, foreign-owned companies taking control of local industry and local scientists working for them.

The traditional response of the scientific community has been to attribute these reservations to the community's failure to understand science, and to try to fix things through Public Understanding of Science campaigns and the like. However, recent research suggests that the primary assumption behind such activities – that ignorance correlates with mistrust of science – may be flawed. In an article on public response to genetically modified food in Europe in the US, Gaskell *et al.*[1] found evidence that higher public knowledge of science in Europe correlated with greater suspicion and caution, while lower knowledge in the US was accompanied by greater acceptance of GM food. Tendering evidence to the UK House of Lords Sir Robert May, the Government's Chief Scientific Adviser, presented survey data suggesting that people in some European countries have a better understanding of scientific method than people in others, and that people in those countries display less unmitigated enthusiasm for science. This, said Sir Robert, is 'exactly as it should be, because the more you understand, the more you understand that things are complicated and advance makes for change, which produces unintended consequences'.[2]

Although more research is needed, it is tempting to theorise on the basis of the evidence to date, that a more scientifically-literate community is likely to be much more questioning and cautious than a scientifically-illiterate one. As science literacy rises, it may therefore become more sensible to engage the community more deeply in discussion about the findings and application of science.

Another approach – that of trying to explain to the community about comparative risks – is unlikely to solve the problem of mistrust. Many attempts have been made to explain that the risks of such-and-such a technology are a thousand times less than flying in a commercial airliner and a million times less than crossing the street, but perhaps these arguments seldom persuade because most people don't have a firm grasp on big numbers, or perhaps because four million years of training in risk aversion means that it is embedded in our genes. Gradually, it is becoming recognised that society sets its own pace for the adoption of new technologies and innovations. While this pace cannot be hastened artificially, it can be retarded dramatically by trying to force-feed the community with something suspect or unpopular.

Superimposed on this is the overwhelming pressure to change imposed by technological advances across the board, and the counter-reaction taking place in society. In absolute terms, humanity is passing through its most innovative period ever: people have adopted and coped with more innovations in the past four generations than in the previous thousand. A study of human development soon brings one across the indigestible term ‘punctuated equlibrium’, which simply means that human technological development appears to have gone by fits and starts – periods of rapid advance followed by long periods of stability or relatively subdued progress. For example, it took about 1.2 million years for the first stone tools to evolve in the Acheulian culture, which itself was around for a further 900,000 years before Mousterian technology replaced it, which lasted 70,000 years or so before being eclipsed by modern stone technologies around 30,000 years ago, which only lasted 25,000 years before bronze came on the scene, which only reigned for 2500 years before iron appeared, and so on. Each step is progressively shorter. However, the fact that there *are* steps is not easy to deny. Humans like to develop a successful new technology and then relax, using it for a while until they feel the need for something better. The surviving hunter-gatherer societies of the earth are the perfect example of cultures that developed all that was needful for survival in their environment, and settled down to enjoy it – it was the influx of alien technologies that was a major force in their destruction. For humanity overall, a situation in which new knowledge emerges almost every day, requiring new skills and new adaptations is beyond all our previous experience. It is very stressful.

It is therefore no surprise that parts of society appear to be suffering ‘innovation fatigue’ – a tendency to call for go-slows and moratoria when confronted with some major new development, a rising resentment and suspicion towards the transnational scientific–industrial complex that is the fountainhead of so many new products and technologies. The habit of many high-tech companies of pouring out new versions and updates is compounding this unease among citizens already annoyed, frightened and resentful at the pace of change. This ‘fear of change’ is superimposed on our already high levels of natural caution where new things are concerned.

A third, as yet poorly defined, factor is the growing resistance towards globalisation. While, on the surface, this might seem to be 19th century trade protectionism in fresh guise, in reality it is quite different: most national governments are signed-on when it comes to globalisation but growing bands of their citizens, including many younger ones, are not.

Their concerns are with things such as cultural imperialism, the obliteration of local industries and traditions, the brutality and selfishness of global capital, technocracy, the rate at which it is damaging the environment and so on. Regardless of one's political views on these matters, it is important to note that the interests of a large worldwide industrial concern do not always coincide with those of a local community, and this mismatch will yield continuing friction. While at present rather inarticulate when compared with the big socialist movements of a century ago, the political potency of the anti-globalisation movement ought not to be underestimated by those working in the scientific and technological industries – not least because it uses the latest in modern communications technology to mount its protests with powerful effect.

In the early 21st century, science and technology thus find themselves confronting a society of which large parts appear to be resisting the advent of new things – a situation vastly different from the post-World War II infatuation with new technologies. Behind the resistance, as we have noted, lie eons of human experience, innovation fatigue and a rising suspicion about global industry. These developments should sound a warning bell in every research laboratory on earth about the importance of developing more effective communication and dialogue with society.

As long ago as 1989, the US National Research Council released a study in which it advocated 'an interactive process of exchange of information and opinion among individuals, groups and institutions,' which it termed risk communication. For the reason given above – that is it subject to misinterpretation by science and technology practitioners – we prefer not to use this phrase, and consider that communication, a 'two-way activity based on trust, respect and openness',[3] is better as a basis for bringing society into contact with a new technology.

Here are a few principles[4] for doing this.

Responsibility

It should first be recognised that the responsibility for ensuring effective communication rests with those introducing the new technology, not with society attempting to find out what it isn't being told. Communication is an intrinsic part of science, and science without communication is socially irresponsible.

Understanding the public

As outlined elsewhere in this book, an understanding of the public, its views, values and needs is critical. This can be obtained by quantitative and qualitative research, media issues analysis and other techniques, such as the use of consensus conferences. It must always be borne in mind that there is no single 'public' but a large number of segments, any of whom can become a bitter opponent if ignored or mishandled.

Credibility

Information will only be trusted by the public if it is seen to come from a trustworthy organisation without hidden agendas or compromising interests and connections. Even then, the information it provides must be seen to be fair, adequate and responsible. It must also be in plain language.

Balanced information

The goal is *not* to make the audience accept the new technology, but rather to provide accurate, balanced and useful information on which it can make up its own mind. This includes admitting possible risks and downsides as well as potential benefits, and recognising scientific doubts.

Expertise

Information given to the public must come from the best research sources available and may cover a wide range of disciplines, many of them outside science. These include fields such as ethics, theology, the law, social science, environmental science, commerce, politics and the humanities.

External critics

Information provided should not only acknowledge scientific differences of opinion over a new technology but also the views of external critics. If it fails to do so it will appear one-sided and polemical – and less trustworthy. The information should focus first and foremost on the immediate concerns of consumers and citizens.

Clarity

Lack of clarity or use of jargon in the presentation of a message can annoy and offend the audience, and fail to inform them. It is advisable to test the message before releasing it, to avoid possible misinterpretation.

Accessibility

The communication must take place in a wide range of media that are readily accessible to the general public, and over a long enough period of time for them to satisfy their information needs and register their views.

Since the goal is two-way communication, every method must provide some way for the public to respond and must invite its opinions. The more interactive the method, the better.

This may all seem like rather a tall order for a simple science organisation. However, another way to view it is that the introduction of new technology is in reality a community-wide partnership involving researchers, government officials, industry, the public, interest groups, the media, the education system and so on. New technology is the outcome of a pan-societal conversation. It will reward the scientific institution that initiates it.

Having started the conversation there are a number of essential steps for it to be carried forward.

Government

Governments are finding themselves left behind by the mad rush of technology, trapped between the conflicting pressures within society for rapid progress and greater caution. Politicians are urgently signaling that they need forewarning of new technologies so they can consider what legislative and regulatory measures should be taken (although, as Chapter 4 points out, it is not easy to focus politicians on the future when their obsession is the immediate present).

Government agencies, born in days of a more sedate bureaucracy when the public could be politely frozen off the doorstep and told to mind its own business, are finding the challenge of the information society harrowing – especially when interest groups can splash their viewpoints all over the world before the first interdepartmental committee meeting has even sipped its tea. They, too, are starting to perceive the importance of having higher order communication skills available (and that does not mean outsourced!), and younger, more congenial spokespeople to explain what they are doing. As for science, the old 'trust us – we know what's best for you' refrain no longer works for bureaucracy.

Much public acceptance of new technology lies with the confidence it has that government, and its instruments, are on the side of the public and protecting their interests. The wave of scandals over mad cow disease, genetically modified food, foot and mouth disease, chemical pollution and the like has led to serious questioning on the part of the public about whose side the bureaucrats are really on. As a consequence, government endorsement of a new technology is no longer as reassuring as it once may have been.

Thus, one of the very highest priorities for a scientific institution with a new technology to introduce will be to brief all levels of government about it thoroughly, to help government understand not just the technology but also its wider implications and to give it an honest account of possible downsides or societal objections. This can only be done through proper opinion research. The objective is to shore up public confidence in the ability of government to manage and supervise the introduction of new technologies, and to give the public a clearer idea of its roles and responsibilities.

Good ways of doing this include:

- commissioning reports to government from independent scientists or institutions;
- briefing key parliamentary committees, ministers and interested MPs;
- face-to-face briefing of senior bureaucrats;
- workshops with government officials responsible for the field;
- by developing joint media awareness activity around the laws and regulations that will safeguard the public interest;
- by developing joint consumer information activity on the same; and
- collaborating on issues such as national guidelines for the release of new technologies, and the development of regulatory frameworks.

Communication methods

Many of the following points repeat those made in Chapter 6, but for ease of reference we thought it sensible to include them in both sections.

- **Fact sheets** and **point-of-sale literature** have long been an important major tool used in communicating about new technologies, but they suffer the drawback of being ‘one-way’, even though contact points may be provided. They can also go out of date quickly as public debate moves on. A growing technique for reaching consumers in developed countries is through supermarket newspapers.
- **The web** provides an interactive way to communicate with the public but, in practice, is generally used as an ‘information dump’ on the unsuspecting user and this can be counterproductive. Despite its vogue with scientific and government institutions it suffers the major drawback of being inaccessible to very large groups in the population, including the elderly, the poor and lower socio-economic groups, the vision-impaired, the illiterate and all those who simply have no access to computers – the vast majority in both developed and developing countries. It also contains an ocean of absolute garbage whose presence

may devalue serious messages in the eyes of users. However, chat-rooms and sites where the public can gain immediate responses from experts to their questions are nevertheless one of its attractive features, as is its ability to signpost other sites of interest and relevance – including opposing viewpoints.

- **Public opinion research**, both quantitative and qualitative, can provide very effective and up-to-date snapshots of what the public, or segments of it, knows and thinks about science and technology issues. Details are in Chapter 12.
- **Media analysis** and **journalists' workshops** are a valuable two-way mechanism for understanding perspectives on new technology as they are put to the public by the media, the media's views on it, and their impressions of their own audience's opinions about it.
- **Consensus conferences** are where a representative group of citizens and a group of experts from science, industry and government meet to discuss the issue in depth over several days, and produce a consensus report covering all those points on which they can agree. While uncomfortable for science and industry, these help them to understand better what they are dealing with regarding public attitudes. These conferences can be broadcast and covered by the media, thus enlarging their audience reach into the community, and public feedback can be built-in.
- **Public fora** are where the public is invited to exchange views with a panel consisting of science, industry and government, as well as consumer, environmental and other interested groups.
- **Industry seminars** are an important way for science and industry to come together to plan the best ways of introducing a new technology. They are generally of greater value where they include representative views from the community.
- **Newsletters** are useful in communicating between organisations and with the media, rather than with the public. The key to success in newsletters is to provide readers with material that is exclusive, informative and useful. Not all meet these criteria. Feedback should always be encouraged and published.
- **Labelling** of food and other consumer products is a vital way to convey objective information about health, safety and environmental aspects of technology. However, it is rapidly becoming so technical it is meaningful only to a very few – and this alone is alienating to many people. Every effort should be made to keep it simple and relevant, avoid jargon and encourage feedback.

- **Radio** and **video** are valuable means of communication in areas where literacy levels may be low, provided the people can receive them. The most effective technique is to present discussion about the new technology involving consumers or users typical of the local community, and noting points both for and against it. The least effective is the scientist in a white coat telling rural workers what they should be doing. Where possible, radio talkback can be used to engender discussion in the community. Even though some callers may seem mindlessly critical, they nevertheless give vent to community feelings and frustrations, and that permits people to feel that their views are at least being registered. Science should not fear talkback, but be patient and constructive.
- **Open days** and **open laboratories**, where the public can stroll through and observe the scientists at work, are a useful way of demystifying research, especially if there is an opportunity to ask questions and exchange views.
- **Specialist media** such as farming papers, hobby magazines, and professional and industry journals are ideal for carrying in-depth articles exploring the various aspects of a new technology, and discussing the pros and cons. A good tip is for the editor to call for reader letters on the subject, to be printed in the next issue. Scientists and regulators can then respond to points raised in the letters, and so a dialogue is created.
- **Shopping centre displays** are especially effective if there is interactivity in the form of a knowledgeable communicator to answer questions and interactive computer programs. There must also be a suggestion box or means for the public to record its views and feelings.
- **Museums, science centres, galleries** and the like are an excellent opportunity to reach the public through more detailed and explanatory exhibits. It is sensible if these are designed as 'road shows' capable of being transported around the countryside. Once again, the seeking of feedback should become part of the 'museum experience', not merely the passive reception of information.
- **Science circuses and drama** are an animated and friendly way to present scientific concepts to children and young students, although here again care must be taken to build in room for interaction.
- **Teacher conferences.** It is sometimes said that teachers who hated science when they were at school are responsible for a lot of the negative messages received in the classroom today. True or not, there is sense in seeing that teachers – especially teachers of sociology, social history, general studies and the like – are better acquainted with

modern science and technology, and have a chance to explore the issues around it. Like other groups, it is important to satisfy both their need for information and to heed their views and values. Teachers are inundated with advocacy literature from various industries and groups. It is more effective to run a forum at their conference than to hit them with an 'information dump' they may regard as propaganda.

- **Politicians**. Chapter 4 referred to the use of politicians as messengers and feedback-providers for science. Few people are so acutely attuned to nuances in community opinion as politicians, and the well-briefed MP can be valuable for facilitating public discourse around science and technology.
- **Religious institutions** are highly engaged in the community's moral and ethical values, as well as issues such as equity, health, safety and the like. They can play an extremely valuable role in facilitating dialogue between science and the community, sharing knowledge and meaning.
- **Non-government organisations** usually have a barrow to push, sometimes negative so far as new technology is concerned. However, they are an important way for science to tune into the articulate concerned in the community – environmental opinion, for example – and should be included in the process of discussion by scientists, not shunned.
- **TV chat shows**. Some scientists might reel with horror, but these too – in spite of a heavy entertainment bias – are a forum for society to dissect and debate new ideas. All that is necessary is for science to accept that its job, in this special context, is to be entertaining. They are useful as a testing ground for ideas because if you can't make it fly there, chances are you will have problems in the wider community. They have the added advantage of a big audience.

These are just some of the many ways of communicating with society about new technology, with the ultimate goal of society gaining a benefit from the discourse. Others may well occur to the reader. However, the important point is not to restrict communication activity to a limited set of methods, but to spread it widely with the object of engaging as much of society as possible.

The GMO syndrome

During the 1990s and early 2000s there was a wave of hostile public sentiment in both developed and developing countries towards genetically modified foods, sharper in some countries than in others, but dramatic enough for some international investment houses to be advising their clients to ditch their biotech shares. This may be taken as a precedent for other technologies launched too hastily on an unsuspecting world.

Although fanned by the media, the hostile public sentiment was clearly discernible in public opinion research (at least in Australia) two years or more before the first 'Frankenfood' headlines broke. In other words, science could have seen it coming had it cared to look and to listen.

Dissecting the various strands of concern that arose in the course of the debate, the main ones were:

- the community not understanding why food had to be genetically modified in the first place;
- community fears about food safety issues resulting from gene modification;
- failure to adequately inform the public, regulators and others about the approach of the technology, how it worked, and what it meant;
- its introduction into the food of hundreds of millions of humans without advice, consultation or permission;
- refusal by industry to 'let consumers know what they are eating';
- initial modifications were seen to benefit multinational companies and some farmers – but not consumers;
- ethical and religious dilemmas posed by cross-kingdom transfers (e.g. a flounder gene in a tomato) leading to perceptions that the technology was 'against Nature' or 'playing God';
- environmental concerns about the consequences of transferred genes shifting to other species, or interacting with existing genes in their new host in unpredicted ways. To the public this raised spectres of other experiments 'gone wrong', like thalidomide;
- domination of the new technologies by a tiny handful of giant US and European corporations (epitomised by the use of so-called 'terminator genes');
- attempts by these companies to patent all genes discovered, whether human or plant;
- anger over 'biopiracy' or raiding of the gene pool, especially in developing countries;
- fears of cultural and biological as well as economic 'colonisation' by big corporations, and lack of global business laws to control them;
- a perception in society that their scientists and regulators were working hand-in-glove with foreign companies to introduce these new foods, regardless of the community's opinions and objections. This led to loss of trust in the integrity of science and in the regulatory system;

The purpose of the list above is not to further berate the poor old biotech industry, which knows well enough by now that it got it wrong. Rather, it is to ask, with the supreme benefit of hindsight, how many of these errors could have been avoided or ameliorated, and can be in future.

Take the issue of safety as an example. While it is true that safety testing of GMOs is now becoming more common, science and industry nevertheless did release foods to tens of millions of people on the assumption that, because a gene was harmless to humans in one lifeform, *ergo* it was harmless in another. There is no scientific basis for this, and it remains an assumption. Indeed there is already evidence from Australia that if a fairly innocent gene – *IL4* – slips into a low-pathogenicity mousepox virus it becomes 100 per cent lethal. A Danish experiment also found that insecticidal genes inserted into oilseed rape shot straight into a neighbouring weed of the same family. So the public may have been sound in insisting that science do a bit more homework before unleashing some of these novelties on people and on the environment.

Ways to hold better discourse with the public are discussed in practically every chapter of this book, and clearly there was much that could have been done in this regard by biotechnology – indeed there is much still to be done. However, the lessons of biotechnology ought not to be lost on other branches of science, such as doctors with a penchant for whacking animal tissues into people (xenografting).

Even computers and modern IT, marvellous though they may seem to their worshippers and to techno-teens, are accruing a subtle back-pressure of resentment among ordinary everyday citizens. Have you noticed how often they are ‘down’ when you go into a shop or visit the bank? Have you noticed that the average time for a transaction has tripled since we left cash behind? How do you react when, in search of specific information, you speak to never-ending layers of computerised voices, all offering you unwanted and time-wasting alternatives? Have you noticed how the paperless offices are more clogged with paper than ever? That you spend longer each day sorting out junk mail, spams, viruses and other assorted assaults on your privacy? That computers are spying on every aspect of your daily life and habits? That they take far longer than an ill-serviced car to get started in the morning? That they are replacing human interaction? Did the IT people *ever* ask you if you wanted *any* of these things?

If it doesn’t look out, the information revolution is going to fall foul of a counter-revolution that will make even biotechnologists cheer up.

A final point on the communication of new technologies concerns the long-term survival of the human race, and the shorter-term survival of about two-thirds of it. The latest insights into the environment and ecology are finding that only large changes in human behaviour and values can repair some of the messes we're getting into. From climate change to ocean and atmospheric pollution, from deforestation to salinity and acidity, from species loss to the growing scarcity of clean, fresh water, humanity is beset by challenges of such magnitude that no scientific 'quick fixes' will do much to resolve them.

The new 'technologies' of the 21st century are predominantly social science in their character because they involve reshaping communities, industries and societies. These are not 'bolt on' technologies like an automobile, a computer or a vaccine, that emerge from the factory fully-fashioned for use. They require understanding, approval and enthusiastic adoption by almost every citizen. They require changes in mindset, morality, tradition, skills and regulation. This cannot be achieved by S&T pursuing its traditional model of 'look what we've invented for you', but only by a strong, dynamic and open interchange of ideas and views, by a discourse rich and full, in which both sides acknowledge one another as equal partners in the science and science communication enterprise.

Chapter 9

Helping science share knowledge

One remarkable omission from contemporary university science courses is communication, both why it is important and how to go about it.

Undergraduate science courses, as a rule, are highly effective at instilling the importance of peer review and scientific publication in specialist journals as a primary communication practice, but there they tend to leave it. As the student progresses to higher degrees it is extremely rare for anything to be done to broaden this emphasis, with the exception of a few bolt-on postgraduate communication courses for those interested in the topic. As a rule, the young scientist will attain fully-fledged professional rank without ever having had more than a glancing contact with the obligations, principles and practices of science communication. It is left largely to their native talent and personal disposition whether they then go on to become an outstanding knowledge sharer or an abysmal one.

Even those fortunate enough also to be teachers and lecturers are rarely taught the skills for dealing with the multitude of audiences beyond the campus. Nevertheless, some scientists become brilliant communicators – the Medawars, Sagans, Attenboroughs, Hawkinses, Dawkinses, Cousteaux, Goulds and the like – who have made the straightforward transmission of scientific complexity and adventure a beautiful and inspiring art. Many other researchers develop into engaging and stimulating apostles for their field, in spite of their academic upbringing.

The very fact that scientists have been criticising themselves and each other for failure to communicate with society for most of the 20th century and into the 21st suggests that something is wrong. A problem so clearly identified and commented upon should not be beyond the combined wit of such an intelligent body of men and women to solve; yet it has proven singularly intractable.

One reason for this may be found in the charming British acronym PUS, which, believe it or not, stands for public understanding of science. PUS appears to have burst forth out of scientific anxiety: 'Why don't they understand us? Why won't they listen to what we tell them?' The problem is that this is a self-centred wish. Its exponents desire society to think in a way similar to themselves, to have a basic grasp of physics, chemistry, maths or biology, to be rational rather than emotional, and so on. They want society to be scientifically literate, whatever that means. In other words, they reject the law of human biodiversity. Public understanding of science, at least in its original manifestation, is a misguided attempt to get the public to think more like scientists and less like the public. In communication terms, this is a dead-end street.

The flawed assumption behind this reasoning was spectacularly highlighted in the debate over genetically modified food. In theory, a public with a higher understanding of science ought to be more tolerant of GM food, while one with a poorer grasp will be more anxious or fearful. Wrong. In Europe, where people are the most scientifically literate in the world, GM foods have been far more sternly scrutinised and criticised than in the US, where the average citizen's level of scientific education is lower.[1] From this it appears that the more society understands about science, the more cautious it is likely to be and the more interventionist it is in the scientific process. And, while it might not look like it, this is actually a positive thing, because it is reassuring to the public.

A second set of reasons why the challenge of science communication remains unsolved are the things that scientists do, both to scientists who are good communicators, and also to professional science communicators. In the first case there is frequently unremitting persecution, criticism, bullying, spiteful remarks, discouragement and outright prohibition inflicted on scientists who wish to communicate and who are good at it. To defy this peer persecution takes great courage, independence and resolve. One of the authors, addressing a gathering of 200 scientists who had volunteered to go into Parliament and communicate with politicians, called for a show of hands to indicate who in the group had been penalised, bullied or discouraged from communicating during their career. The response was more than 95 per cent.

This suggests there is something amiss with the sociology and culture of science that can probably only be set to rights in the very early phases of training – the undergraduate and postgraduate years. Later, there is also something gravely wrong with the system of recognition, reward and promotion, which values published scientific papers but does not value articles published in the mass media that may reach, inform and benefit millions.

Cullen and Markwort,[2] working for one of Australia's most communicative science centres, the Cooperative Research Centre for Freshwater Ecology, warn:

> *(scientific) publishing is necessary, but no longer sufficient for survival in science… The media is a key tool in communicating our various messages and positioning our 'product'. Our product is knowledge. We must build support for developing knowledge, which we find a more understandable term than research. We must also influence the community to change behaviours.*

Explaining their philosophy more fully they add:

> *We will not achieve our vision of improving the condition of our waters without convincing the community it is desirable and showing them how to do it. Communication is therefore a core function of our organisation, and this is reflected in staffing and budgets. It is also reflected in the amount of time our Board spends looking at our communication work, which is reported at each meeting. We plan our communication in a strategic sense, just as we do our research work, and we demand the same level of professionalism and excellence in our communication activities.*

As to the general treatment of science communicators by research institutes in general, there is also something astray with a system that draws an artificial distinction between those who discover knowledge professionally and those who share or communicate it professionally. Both functions are of equal importance and value to the society. Until there is parity of status (and pay) between the two, it is unlikely that science will truly value the function of communication. While communicators remain second-class citizens in scientific institutions, knowledge sharing will remain a second order priority. This also means the organisation will be less sensitised to views and developments in the outside world, and less able to respond to them.

Cullen and Markwort said that having professional communicators in their research organisation had many benefits: staff saw communication as core business, not just as an add-on, strategic allocation of resources, larger communication budgets, making media work a pleasure for scientists rather than a chore, and sensitising staff to opportunities to get their message to wider audiences.

In an analysis of the impediments to scientists communicating through the media, Gascoigne and Metcalf[3] concluded that the main reasons were that scientists regarded it as optional, saw it as neutral or negative to their careers, believed that management was unsupportive, and they lacked experience and lacked access to professional advice from trained communicators.

The problems identified here can be overcome by:

- instilling in future scientists, while they are undergraduates, that they have a public duty to communicate with the wider world as well as their peers, along with some basic clues about how to do it;
- giving them confidence-enhancing and skill-enhancing training and experience throughout their research career;
- rewarding, honouring and acknowledging good science communication by scientists and others;
- fostering a culture of openness, listening and sensitivity to both proximate and ultimate research customers;
- management adopting a strong pro-communication policy and leading by example;
- ensuring the availability of sufficient professionals and resources to help the organisation and individual scientific teams to share knowledge more effectively;
- building communication activity into the delivery of every significant research project, and its budgeting; and
- giving communication professionals status, rewards and incentives on a par with professional researchers and research managers. By seeing them as part of the team, not as supernumeraries.

The remainder of this chapter deals chiefly with the second dot point, and offers some basic hints for scientists interested in becoming better external communicators and knowledge sharers of their work.

Many of these points were dealt with in Chapter 3 and elsewhere, but are here summarised in the form of accessible advice that a researcher might keep handy in their desk drawer, on their notice board or computer for easy reference.

Scientific institutions often demand good reasons why they should put their slender resources into communication. The following reasons were suggested by scientists themselves during workshops in Indonesia and Australia.

Why communicate?

- to transfer to society the benefits of research;
- to help make the world a safer, more prosperous and sustainable place;

- to advise leaders and policy-makers about the latest progress and its meaning for society;
- to get opinions, needs and feedback from society;
- to prepare the public for the advent of new technologies and change;
- to help governments make better policy;
- to alert industry, other researchers, developers, educators, the media and research users of recent progress to speed the delivery of new knowledge and technology;
- to get closer to industry and better understand its needs;
- to enhance economic growth and sustainability;
- to attract greater investment to science and technology;
- to attract young people to a career in S&T, and to interest and inform those who will pursue other careers; and
- to share the joy of knowledge.

Why scientists don't…

Scientists have also advanced the following reasons why communication fails to happen as well as it should:

- they mistrust or misunderstand the media and its motives;
- they lack confidence in their own skills;
- they have not been trained to communicate with external audiences;
- they fear the reaction of their colleagues;
- they see no career advantage or reward;
- they are too busy;
- they fear their work may get into the wrong hands;
- they are restrained by confidentiality arrangements;
- they fear public reaction to their work, especially if based on a misunderstanding;
- they fear criticism from lobby groups and vested interests;
- they are restricted by an exclusivity clause imposed by their intended professional journal of publication; and
- their leaders and managers discourage communicativeness.

Hints for scientists[4]

Hints for media interviews

Before you accept a media interview, it is a good idea to discuss it with your research leader, an experienced colleague or professional science communicator. This will help you to marshal your arguments and anticipate sensitive issues. If you haven't much media experience, a short media skills course is highly recommended to help you get your message across effectively and with the least scope for inaccuracy. The following suggestions will also help.

- Find out what the media story is about, and what your role in it is likely to be. Ask the journalist directly what their story is and what angle they are after, because you want to be as helpful as possible.
- Keep your message simple and brief. Prepare it in advance. Don't let yourself be diverted from it.
- Write down your two or three main points, and ensure you make them in the time allowed. Ask how long broadcast stories are likely to run for and time your statement accordingly.
- Shape your message carefully to your audience. If you don't know who the audience is, ask the journalist who their program or paper reaches. Use plain language always. Talk money to business media. For general media, speak as you would to your auntie. Remember it is *your* audience you are addressing, not the journalist.
- Help the media to 'get it right' by providing a concise written summary of your work. This could be a copy of your project description or a scientific abstract, but a specially written one-pager is desirable.
- Accentuate applications and outcomes. Explain why your science is important, its value to industry or the public and how it might benefit the nation.
- Respect the journalist's deadline. Do everything you can to help ensure they have all the information they need to meet it.
- Don't assume any technical knowledge on the part of the journalist. However, if you know the journalist well, he or she can often help you to interpret your message more clearly and interestingly for their audience.
- Don't say 'no comment'. If you cannot comment, explain why.
- Don't tell a journalist how to write a story or insist on 'clearing' it. Offer to check your quotes and general scientific accuracy, but remember the media has pressing deadlines and offer 'instant turnaround'.
- Avoid using too many facts and figures, qualifications and technical terms that may confuse or mislead your audience. The media will use only a part of what you tell them – the clearest part.
- Try to avoid raising false expectations with regard to a scientific outcome or the timing of its delivery.

- Make clear to the journalist your field of expertise, and when you are going outside it. Help establish the credibility of your work by reference to the peer review etc. it may have undergone.
- If a media story contains an error, a sensible approach is to seek a follow-up story that clarifies or amends the mistake. Threats and demands for retractions antagonise the media and don't advance the communication of your science. Be patient and, if possible, forgiving. Discuss attempts at clarification or letters to the editor with someone who knows media.
- Provide the media with other authoritative scientific, government or commercial contacts they can approach for comment that supports or compliments your story.
- Provide the media with picture and vision opportunities of yourself, your research equipment and subjects in action. This will greatly increase your chances of coverage. (N.B. computers make poor pictures)
- Pictures, illustrations, graphics and tables are also welcome and help the media flesh out a story.
- Don't be surprised if the media show interest in you personally and your feelings. They are always looking for the human angle to a story.
- Dress to suit your message but, if possible, avoid looking like a boffin. Don't wear stripes on TV. Try to create an image of scientists as trustworthy but normal people.
- One-time interviews can be unsatisfactory. If you can see scope to build a relationship with the journalist, do it. If they regard you as a source of future stories they will be more inclined to handle you gently.

TV and radio interviews

Success in radio and TV depends not only on capturing the essence of what your research means in a few well-chosen words, it is also how you look and sound. Trustworthiness depends on appearance as much as it does on the content of what you say. A nervous, shifty manner, outlandish appearance or quavering voice can undo the best-planned script. As radio journalist Carolyn Watts says: 'Interviews are about people'.

Unless you are very experienced, it is sensible to go through a small relaxation program immediately before an interview. This will help you clear your mind of extraneous thoughts, focus on the message and, above all, appear relaxed, calm and confident. Some possible steps are:

- adopt a comfortable, balanced stance or upright sitting posture with your weight evenly distributed and not leaning forward, back or to one side;

- take several deep breaths and exhale slowly;
- relax a major muscle group of your body – chest and arms, abdomen and back, legs and hips, head and neck – each time you exhale;
- focus inwardly and clear your mind;
- be silent for a few moments;
- smile pleasantly;
- call to mind your chosen audience – the person to whom you will speak (not the journalist);
- review each of your main points and rephrase them if necessary; and
- go straight into the interview while you are still relaxed.

At all times keep in the forefront of your mind your target audience – your auntie and her needs. This will enable you to keep cool if the questions become aggressive or challenging, and to return the interview to your chosen subject if it moves away.

In both radio and TV, answer the question clearly, concisely and courteously and then *shut up*. One of the most devastating weapons in the electronic journalist's armoury is the meaningful silence that compels the interviewee to keep talking. Don't let yourself to be trapped into saying more than you intended or else you may find that what you meant to say is edited out in favour of what you didn't.

Try to smile at the interviewer. It makes you both look and sound less defensive and more positive. Even on radio, smiling comes through in your tone of voice and makes you sound more engaging to the audience.

Let your pride and enthusiasm for your work show. In the lab it may be *de rigeur* to be cool and forensic. In the media, let your personality convey how much the research really means to you and to others.

In phone interviews, speak across the top of the telephone mike as it reduces the 'breathiness' of your voice. Avoid drumming fingers or fiddling with pens or other objects that may cause background noise and indicate nervousness. Sit away from buzzing equipment that may cause interference. Switch off your mobile.

After the interview is over, if you must say something then simply talk about the weather or other pleasantries. Beware the mike or camera that may still be live.

Be gracious, and thank the interviewer for his or her time. It never hurts to dispose them in your favour before they begin to edit the interview.

Practising TV interviews in front of a camera and reviewing your mistakes afterwards is one of the most educational things you can do. We all have images of ourselves that bear little resemblance to what others see – especially on TV!

Hints for speeches and presentations

Effective presentations by scientists are important to the public reputation of their institution or team. They are a powerful way to:

- inform and educate;
- persuade or motivate;
- initiate policy discussion;
- review; and
- inspire and entertain.

If you're new to the game, or just a bit rusty, a short presentation course can work wonders and is a sound investment of even scarce R&D funds.

In presentations, good advice is: 'Tell them what you're going to tell them. Tell them. Then tell them what you just told them'.

Presentations should be logically organised and signposted. They should give the audience visual images and words that continually bring out the key message you are trying to convey.

Good presentations involve the following steps:

- analyse your audience and what it wants from you;
- set your communication objectives;
- assemble data, ideas and material to support your objectives;
- arrange the material in a sequence that is clear, commands attention and is persuasive;
- prepare an introduction that explains what you are going to say, and the signposts;
- work up a powerful take-home message for your conclusion;
- prepare visuals and fit them to the talk;
- limit the number of slides or overheads strictly – the fewer the better;
- limit the number of ideas or statements per slide or overhead to between three and five;
- avoid slides with tiny print, lots of figures or messy lines. Use pictures, if possible, and simplified graphs or tables;
- read and rehearse the full presentation, including tonal variations in voice, different gestures and body language;

- check out the venue's projection or overhead facilities, microphone, lectern, water, pointer etc. Do they all work?
- after delivery, review and evaluate. Ask someone in the audience to give you constructive criticism and feedback.

Modern computer presentation technology, digital cameras and multimedia offer the speaker unprecedented variety and opportunity. There is no longer any excuse for a drab and dull presentation. Take advantage of the new technology – fly-ins, animation, bright colours, streaming video, audio files, picture editing, 3D graphics. It doesn't trivialise science, but enlivens it.

The big mistake made by many scientific presenters is to haul their presentation together at the last minute from a heap of slides or dog-eared overheads. This relies on their expert knowledge, rather than presentation skills, to pull them through. This may be tolerated among colleagues, but it is no longer good enough when addressing audiences of industry, politicians, stakeholders, funders or the public. It sends a message that, no matter how good your science is, your attitude to your audience is casual and unprofessional.

Hints for public reports and media statements

- Put the conclusion first. Keep it clear and simple. Strive for impact.
- Explain the relevance of the science to the general public, industry, government etc.
- Quantify where possible the economic, social or environmental value of the research.
- Describe it simply, with the outcomes first, and method and data second. Avoid technical language and bureaucratic language. Avoid scientific terms that have different meanings in general usage.
- Write short, crisp sentences. Strive for clarity. Limit the number of ideas conveyed per sentence to one. Keep paragraphs short. A staccato effect heightens the impact.
- Use the active voice rather than the passive.
- Support written material with clear graphics, tables, diagrams and pictures where possible.
- Use an eye-catching title or heading that will grab the reader.
- Provide a riveting executive summary, remembering this is as far as many readers will go.
- If the report is for media use, include quotations that are directly attributable to you and your partners.

- Ensure your report has contact details: phone, fax, email, website and mail. Include an after-hours or mobile number where possible.
- Private industry is one of the most effective and valuable means for science to share its knowledge with the community, the nation and the world at large. Provide contact details for research partners, stakeholders and other relevant parties.
- Clarify the clearance procedure. Where there are several partners, make sure each is satisfied with the acknowledgement they receive, and that their titles and logos are adequately displayed.

Chapter 10

Rules for speaking out

Sensible guidelines for public communication

Modern science exists and goes about its business because society permits it to do so: the community gives sanction (as well as funding) for research to be performed. This is a point sometimes overlooked by public research establishments, especially those with decades or centuries of academic laurels behind them. However, it doesn't take many errors of judgement or ill-considered public statements to place an institution and its funding on thin ice.

Since the public, government and funding sources will generally base their impressions of the value of an institution on its collective public utterances (as distinct from its scientifically published work), it makes sense to have some basic guidelines for staff on how to go about communicating with the wider world, be it with government, industry or the community at large.

Where the institution derives a significant part of its funding from the taxpayer there is also a duty to share with society the fruits of the research. When this is neglected there is a danger its scientists will be seen to be 'pursuing their own hobbies at the taxpayer's expense'. A primary reason for communicating externally is to 'report to the shareholders', to facilitate the delivery of benefits to the community, and to demonstrate that the institution is a worthwhile public investment.

It is remarkable how often the formal charter or legislative act of modern scientific bodies, while stating the research mandate emphatically, somehow manages to overlook the obligation to share knowledge with the wider society (as distinct from normal educational activity). There is an ethical view that says: 'If the people have paid for it, the knowledge produced belongs to the people, not to the institution or the researcher or research partner even though they may have contributed some of the cost.' A task for any research institution wishing to prosper in the 21st century is to revisit its charter and to amend this omission, if it exists.

Of equal importance is for the institution to send the correct signals to its research staff about their duty to communicate: that it is expected of them to do so proficiently, that good research planning includes planning to communicate the work, and that the rules of public comment encourage, rather than hinder, this process.

There are many ways to go about establishing sound communication guidelines. The following, which cover the key points, are adapted from those of Australia's CSIRO, a publicly owned research agency with an international reputation.[1] They may serve as a template for other bodies wishing to enhance their capacity to share knowledge. They begin with a general statement of policy.

We are committed to excellence in science. We are also committed to delivering outcomes based on our science and to communicating our science.

Communication is a part of our charter. It is encouraged by the Organisation and it is seen as essential for the successful adoption of the outcomes of our research by industry, government and other stakeholders. It is vital to the national debate about our common future.

The Organisation's claim to be a leading provider of excellent science will only be convincing if we continue to provide the nation with examples of what we are achieving.

The Organisation only exists because of community sanction. We must never lose that, and one way we can make sure of this is to continue to report what we discover and achieve for the benefit of the community. We must also listen carefully to the views and values of the community about what it expects of our science.

The standing of the Organisation in the wider community gives us scope to influence the nation in favour of scientifically literate policies. It also induces far-sighted and competitive industries to use the results of our research. Our reputation rests significantly on public awareness and approval of our scientific achievements.

Staff are encouraged to communicate with industry, government, the public and media, effectively and responsibly. These guidelines are designed to help you. The Staff Code of Conduct and the Commercial Practice Manual also contain policy statements on communication issues.

What is public comment?

Public comment includes public speaking engagements, submissions to public inquiries, comments on radio, television and in the newspapers, views expressed in letters to the press, in books, journals, in brochures, magazines or on the internet – in other words wherever it is likely that publication of comment will flow to the community at large or a significant part of it.

A guiding principle is that public comment should take account of the need for constructive relations with stakeholders in industry, government, the community and within the Organisation, and not injure our scientific reputation or standing in the community.

Public comment on scientific issues

Staff have a responsibility to communicate with the public and industry about scientific aspects of their work. The Organisation encourages this, subject to various laws and policies. Effective public communication is included in staff evaluation and promotion.

The Organisation encourages its staff to contribute to the public debate on scientific issues within their area of expertise. Such comment should always be tempered by judgement and tact.

It is not expected that staff will comment on scientific matters outside their expertise or on non-scientific matters (e.g. politics, or religion) unless they are authorised to do so, or they are quite clearly commenting in a private capacity and the name of the Organisation is not linked to their remarks.

Departmental heads are formally accountable for judgements exercised on matters of public comment within their department.

Media announcements

Official media announcements are made through the Organisation's external communication unit or through individual departments.

If you have a subject you consider suitable for local, national or international announcement or comment, it is a good idea to discuss it with your science communicator or with the external communication group to obtain their advice on the most effective way to go about it.

Media releases are drafted either by your own science communicator or the external communication group in consultation with you and your colleagues, then cleared by the relevant officers in your department and any research partners. As timing can sometimes be crucial, your help in keeping the clearance procedure swift and accurate is appreciated.

Scientific opinion

There will always be issues on which Organisation staff hold differing scientific opinions. This fosters healthy debate and helps the Organisation to develop a balanced position. However, the community sometimes expects a uniform institutional view on a topic and it may occasionally be desirable to try to reconcile widely differing scientific opinions or else form a judgment as to their merits.

Good internal communication, including close collaboration between managers, is essential in helping to resolve differences of view or deciding how best to explain them. Public debate in the media over differing views should be part of a planned strategy to help the community understand that a range of scientific opinion exists and that further research is required to clarify uncertainties or determine where the weight of evidence lies.

Respect for the work of colleagues is very important. It is sensible to make yourself aware of the work of other Organisation researchers (and that of partner institutions) who may be involved in the same issue and to check with your research leader or a communicator before committing yourself to an important public statement.

If the issue is sensitive or controversial, please inform your research leader or communicator about your intended public comments. This enables them to provide supporting comment if approached independently by the media, and also to brief you on aspects of the issue and how it affects the Organisation of which you may be unaware.

Where you are aware of diverse views on your topic within the Organisation, courtesy as well as common sense makes it advisable to let the other researchers or their groups know your intentions.

Partnerships and commercial collaboration

Modern science involves extensive partnership and collaboration with many other public and private research institutions, government agencies and private sector companies. While we are firmly in favour of disclosure and knowledge sharing as a general principle, it is important to recognise that there may be legal limitations, contractual obligations as well as the feelings of partners to be considered.

Take care not to disclose unauthorised information about a company, government agency or other organisation working in partnership with our Organisation or which has signed a contract with us to do research. Its release might cause embarrassment or financial loss to the other party, may constitute a breach of contract and may harm our standing as a reliable provider of research services.

Should you be asked to comment publicly on the activities of any commercial or partner organisation, it is advisable to contact that organisation before making comment and seek their reaction to the request. Ascertain whether what you may disclose is subject to a legal confidentiality agreement.

Should the partner not wish you to disclose facts which you feel we have a duty to disclose in the public or national interest, discuss the matter with your *research leader and/or senior management. Please don't simply disclose those facts unless you are authorised to do so. The Organisation feels strongly its obligation to the public interest and also to its research partners. Balancing these requires tact and careful consideration.*

Non-scientific issues

Public statements on non-scientific issues are sometimes made by our scientists as a part of their duties. This responsibility will be given to you by your manager, who is required to brief you on all relevant issues and keep you informed of important developments. You are accountable to your manager for any such statements made, and responsible for informing colleagues who need to know what has been said.

This Organisation provides objective scientific information. Though it may contribute to the formulation of policy by government in an advisory capacity, it does not publicly comment on policies adopted by the government, the opposition or other political parties.

Personal comment

If you wish to publicise your own views on an issue but are not authorised by the Organisation, you may do so freely as a private individual. However, you must state plainly that the opinion you give is a personal one and not an official or unofficial view of this Organisation. You are asked to help the media to understand the distinction.

Staff whose duties include advising on, or implementing, aspects of government policy should avoid public comment which might conflict with those duties.

If you have any doubts or concerns about expressing a personal opinion, and whether it may be interpreted as an official view, you are encouraged to run them past your communicator or manager and seek their advice. It is also advisable to inform your manager if your views are likely to stimulate public debate or provoke controversy.

Senior managers need to take particular care when making public comment in a private capacity as, despite their insistence that they are speaking privately, they may not be able to escape identification with this Organisation.

Please don't use Organisational letterhead, envelopes, fax headers or e-mail systems for correspondence in which you express private opinions. The use of any form of the Organisation's name, logo or livery will convey an impression your comments are official and authorised.

Public inquiries

Staff are at liberty to make personal submissions to public inquiries with the same qualifications that apply to public comment: do not disclose confidential information without authority, consult your manager and make it clear that your views are privately held. Don't use official stationery or hardware.

Official submissions, which address matters on which the Organisation has acknowledged expertise and authority, should be handled by the senior manager responsible for your department, or through the Chief Executive's office.

If you are asked to appear as a witness before a Parliamentary Committee, contact the Ministerial and Parliamentary Liaison Office for guidelines that will assist and protect you.

External bodies

Our staff are often asked to serve on external bodies such as committees of inquiry and reviews of other bodies or laws, or as members of community organisations. First, establish whether you are being invited as a representative of the Organisation or as an expert individual.

If you represent the Organisation, make sure so far as possible that your comments are consistent with official policy and corporate knowledge on that topic. The task may call for careful differentiation between formal policy, a consensus position among our staff and the need to use your own professional judgement. As you represent the whole Organisation, you should consult colleagues who may be able to contribute information and advice that will help you.

If the external body wants you in a personal capacity, make your private status quite clear and insist that nothing the external body says or publishes can be attributed to the Organisation. You should also notify your research leader or manager.

Your first point of contact on any aspect of public comment is your Department's Science Communicator. If you would like advice from our External Communication Office, they may be contacted at...

The document then goes on to list the various laws, statutes and codes of practice to which employees are subject, and to explain briefly their obligations under each. These include:

- any restrictions imposed by the enabling Act or charter of the organisation on public comment;
- government or public service rules on public comment, where the organisation is a government statutory authority and its scientists technically public servants;

- national security restrictions that may limit public comment on certain issues and impose penalties on those who break them;
- privacy laws that may prevent the organisation from disclosing private and personal details of individuals involved in its research activities;
- terms and conditions of service imposed by the organisation and agreed to by individuals at the time of their employment;
- defamation and libel laws;
- commercial and other contractual agreements with research partners;
- intellectual property and copyright laws;
- scientific ethics codes; and
- the organisation's code of external business practice.

In the case of CSIRO, the guidelines are then rounded off with a series of hints to scientists on how to handle the media, how to write a public report, how to give an effective public speech or presentation, where to get training and the Organisation's media release procedure.

The most convenient way to disseminate public comment guidelines is via the intranet, if this reaches all staff, or else through an inexpensive booklet that is issued to all staff for easy reference. The guidelines must be regularly reviewed to take account of organisational change as well as changes in the external context, such as new laws and regulations.

Striking a balance between a scientific institution's natural desire for freedom of speech and its obligations to an increasingly complex network of partners, funding agencies, government bodies and legal requirements is an extremely delicate business. It is worth bearing in mind that the imposition of authoritarian rules and restraints on scientists' freedom to comment publicly can not only cause resentment but may actually backfire if individuals decide to challenge or ignore them. Appeals to common sense, courtesy and loyalty to one's colleagues, along with a consultative approach, are more likely to prove effective.

In the opinion of the authors, the important thing from the standpoint of knowledge sharing and human progress is to keep scientific freedom of speech and public comment as unrestricted as possible, and for researchers to feel they are both encouraged to communicate, rewarded for doing so and will not be punished or persecuted if they do it in a considerate way. Far too much science is hidden from the public, not because its disclosure is forbidden but because the web of conditions, restrictions and implied threats that surrounds it serves as a deterrent to the scientist.

Finding this web too tangled and complex to negotiate, many researchers simply decide it is easier not to communicate their science at all with a wider audience beyond their peer group. Scientists who are hesitant about their public communication skills, or who view communication as a distraction from their scientific goals, may also use this web of restrictions as an excuse for shirking their public duty to communicate. Where scientists fail to communicate externally, they lose the benefits of public or industry feedback on their work. This exposes them to the danger that their science will fail to meet community standards or needs, or that its adoption or commercialisation will be protracted and costly or else fail altogether.

It is not in the interests of either science or society for knowledge sharing to be impeded in this way. Clear guidelines are one way that the senior management of a scientific institution can send an unambiguous message to staff that communication is an approved and valued part of the process of knowledge sharing; indeed it is a duty. However, it is also important for these guidelines to be prepared and agreed to in a transparent and consultative process within the institution or else staff will feel no ownership of them and little motivation to understand or observe them.

It is also desirable that systems of reward, recognition and promotion in scientific institutions take far more notice of the duty to share knowledge with the wider community than has been the case until now. For scientists to be rewarded or promoted predominantly on the basis of research, discovery and scientific publication devalues the part of the knowledge process that actually makes their work of worth to society.

Forward-looking research institutions are now experimenting with new ways to honour, reward and motivate staff who show a commitment to knowledge sharing. These include:

- annual performance evaluation and key performance indicators that are specifically related to science communication, as distinct from purely research activity;
- inclusion of a ‘duty to communicate’ clause in the employment contract and job description of every researcher, especially research managers;
- permitting staff to retain income earned from external speaking engagements, media appearances, general publications and the like;
- requiring a communication plan for every significant piece of research as a condition of funding support;
- including an ‘agreement to publicise’ clause in commercial research contracts;
- providing free training in media skills, public presentation and science writing to staff;

- nominating staff for external awards and distinctions that recognise the value of good science communication;
- creating internal awards, of equal status with scientific awards, specifically for science communication/knowledge sharing;
- recognising the value that trained science communicators can contribute, not only to the organisation but in helping individual scientists to be more effective communicators of their work;
- paying science communicators on the same scale as researchers to acknowledge the equal value they contribute to the knowledge process; and
- cultivating a ‘heroes of science’ policy that actively seeks to promote individual scientists to the public in the same way that sports stars and other cynosures are recognised. This also involves active efforts to allay internal jealousies and resentments.

Chapter 11

Issues and image management

An organisational 'crisis' is an event that injures the good name, level of trust or scientific credibility of the institution with its stakeholders, customers, partners, peers and the general public and limits its ability to do its job. It may also have a wider impact, adversely affecting the community or even the nation.

In most cases it is an outcome of poor planning and bad management on the part of the research organisation and not, as is so often thought, purely a consequence of attacks by malicious critics or a mischievous media.

An 'issue' is anything that has the potential to affect the performance or reputation of the organisation, either positively or negatively. Not all 'issues' need to be bad news. In some cases, positive issues can be managed in a way that brings greater credit to the organisation and enhances trust in its work.

However, an issue becomes a crisis when, through a failure to anticipate and manage it properly, it goes out of control in a seriously negative fashion, or when an unanticipated internal or external event precipitates it. There are generally three types:

- sudden crises (e.g. natural disasters, fires, major accidents);
- emerging crises (e.g. a build-up of adverse comment in the media, leakage of sensitive information, industrial disputes); and
- chronic crises that run for long periods, sometimes years, with periodic flare-ups and lulls.

Good management of issues and crises involves firstly the identification of such issues, including the ability to understand how they are likely to be perceived by external audiences, and then the development of a plan to manage the issue. The basic philosophy is that prevention is far better than cure.

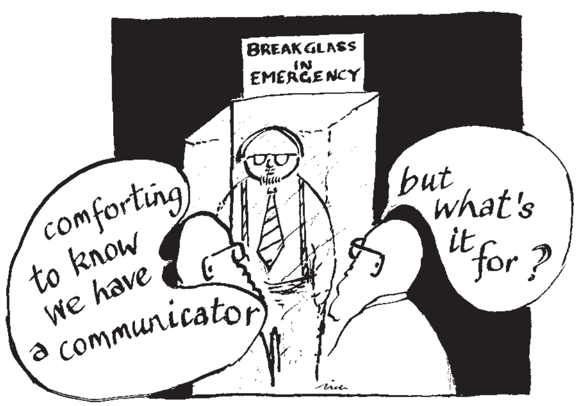
Most medium and large companies have an issues and crisis management strategy, and devote significant staff and financial resources to spotting and heading off problems. They recognise that a poorly handled issue can cost billions of dollars and destroy the good name of the organisation. Most scientific institutions, on the other hand, cling doggedly to the wishful belief that 'it'll never happen to us', (in spite of ample evidence that it happens several times per year). This is partly due to the scientific conviction that a dollar spent on 'administration' is a dollar wasted, and to a lack of awareness that damage to the organisation's reputation also spells damage to its scientific credibility, at least in the eyes of the public, politicians, stakeholders and funding sources. Consequently, scientific bodies experience quite a lot of crises, are generally taken by surprise when they break out, and are forced adopt a 'bushfire' approach to their control (as distinct from a fire-reduction strategy that aims to remove the fuel).

Issues affecting scientific institutions tend to arise in one or more of four areas:

- scientific and technical;
- commercial and legal ;
- organisational and policy; and
- people, health, industrial, safety and property.

In planning to avoid a crisis, it is sensible to evaluate every unit or department according to this framework in order to be reasonably confident of anticipating what may go wrong.

The best way to do this is for each unit to have its own issues and crisis management (ICM) team that scrutinises the full portfolio of activities on a regular schedule and prepares a brief summary of each issue identified. It is also crucial to enlist staff support for this process. One of the most



effective ways is to explain to all staff what an issue is and why it is important to manage it, then to provide them with the contact details of key members of the ICM team, and ask them to report to these individuals any issue they consider to be of concern. This way the whole staff shares responsibility for upholding the organisation's public reputation and feels engaged in the process without being burdened by large administrative responsibilities.

Unit ICM teams then provide regular reports on their most prominent issues to the organisation's overall ICM team. This typically consists of the director, vice-chancellor or chief executive, the chief legal adviser, the human resources manager, the chief communicator and the manager(s) of the area in which a particular issue has arisen or that is affected by it.

Once an issue has been identified and defined, a plan is drawn up to manage it. This plan may involve ongoing active management by many people, or it may simply be a document that sits in the bottom drawer for use in the event that the issue escalates.

There are two golden rules of issues management:

- the public interest is paramount; and
- there is an absolute commitment to openness and honesty.

These are easy to say, but can be unbelievably difficult to follow in practice. The first is often broken because institutions (and companies) perceive their own interest and welfare as the first priority, not realising how much damage they can inflict on it by being seen to place it above the public good. Indeed, many institutions experience great difficulty in discerning between their own view of what is good and what the public considers to be good. To follow this rule requires the discipline of managers of the institution being prepared to step outside their internal focus and place themselves in the shoes of the community and stakeholders as they view the issue. Failure to do this will leave a lasting public impression that the institution is narrow, selfish, biased, arrogant and unworthy of public support or credence. In extreme cases it may lead to the withdrawal of public sanction for it to perform science, or to legal prosecution.

Another reason it is very hard for modern scientific bodies to put the public good first is because of binding commitments to commercial and other customers. Nevertheless, a scientific organisation that consistently appears to place the interests of 'big business' (or 'big government') ahead of those of the community will experience a grave loss of trust, credibility and, ultimately, public willingness to adopt, use or buy its research products, which will backfire on its industry customers.

An interesting way to test your organisation's capacity to handle issues is for management to pose itself a question like this:

> *If, in the course of commercially confidential contract research for a big food company, you discovered food poisoning microbes in their production process, whom would you inform first?*

Those who reply 'the commercial partner' are probably not yet in a frame of mind in which they can successfully manage issues or protect their own reputation. They will be inclined towards cover-ups.

The second golden rule of absolute commitment to openness and honesty is equally challenging, especially for those organisations with a strong bureaucratic or academic tradition of secrecy. However, few things are more harmful to a reputation than a public perception of dishonesty or contempt for the public's 'right to know'.

As in so many human relationships, honesty is the best policy and truth the safest course. If the organisation has erred in some way, a confession and a plea for public forgiveness are more confidence-inspiring than a botched attempt at a cover-up. The literature on corporate crisis management is filled with case studies that reinforce this principle; indeed there are many cases where absolute honesty and candour led to the organisation's standing being enhanced, rather than diminished, by the issue.

Of course, organisations do stage cover-ups and get away with them – but any smug self-congratulation at having successfully 'handled' the issue and put the media off the scent is likely to be short-lived if it becomes habitual policy. Not least of the reasons for this is that all organisations contain honest and decent staff who are likely to be offended, if not morally outraged, by a cover-up and who may, because of the affront to their own standards, be strongly inclined to 'blow the whistle'. Scientists, more than most professions, feel a compulsion to speak out if their values are affronted. One of the best ways to view an issue is to assume from the start that it will eventually become public knowledge, and to plan the response accordingly.

Here are some basic steps for establishing an issue management plan.

ICM team

Decide who is to be on the ICM team. These must be prepared to drop all current commitments and responsibilities to focus totally on the issue. List all their 24-hour contact details.

Short description

Prepare a concise written description of the issue, explaining clearly what it is about and its possible ramifications for the organisation and the community.

Our policy

Draft a succinct statement of the institution's position on this issue. If none exists, then draft a recommended policy.

Spokesperson: 24 hour contact

Nominate who is to be the lead spokesperson on the issue. This individual is chosen on the basis of seniority, knowledge of the issue, reassuring demeanour and ability to stay cool under fire. This individual becomes the public face of the institution while the issue is running and must be contactable around the clock.

The public position

Summarise the issue and what the institution is doing about it, in plain language and dot point form. Use an experienced communicator to draft this document, which is for use by the spokesperson, other staff who may be asked to comment, and to brief stakeholders. It will also be used to respond to media and public inquiry.

Legal obligations

The ICM team must methodically consider every aspect of the issue from the standpoint of the institution's legal and contractual obligations. It is common for the legal adviser to be a key member of the ICM team.

Stakeholders

The ICM team must prepare a plan for informing key stakeholders about the issues, and whether it affects them directly or indirectly. These approaches are best made in person to gauge the response of the partners and whether they are likely to help or hinder effective management of the issue.

Other managers

The heart of good issues management is good internal communication. The ICM team always includes several senior managers and, often, the head of the organisation. However, it is essential that other managers be kept in the loop with regular updates and consultation, and can feed in their advice readily. Any of them could face media or stakeholder demands for comment. They must also be in a position to brief and reassure their own staff.

Government

For public research institutions and universities and companies that produce consumer goods, it is essential to keep government fully briefed on the situation, in particular the office of the Minister responsible. Politicians hate being taken by surprise and crises can be used by political opponents to mount an ambush.

Tell the staff

A plan for informing the staff is essential. This must swing into effect as soon as the issue becomes, or threatens to become, public. Informed staff are likely to be supportive and helpful; staff kept in the dark by a thoughtless, secretive management are likely to feel resentful and angry, and may be tempted to add their voice to external criticism. Media often get their leads from concerned staff, or from chatting with contacts who work for an organisation. A journalist who has run into a brick wall of 'no comment' may turn to the switchboard operator, the canteen staff or a former schoolmate for leads to follow up.

Public response

The ICM team prepares a step-by-step plan for responding to public concern and inquiries, ensure staff clearly know what their role is and adequate resources are available. The response must take first account of the public interest (e.g. safety, health, jobs etc.) as opposed to the institutional interest. It must be easily accessible through hotlines, email and web services, public briefings, media announcements and the like.

Media response

Identify key media and journalists to be contacted and briefed on the issue. An informed media that is taken into the organisation's confidence will often prove more of an ally than a foe. Silence and an uncooperative stance, on the other hand, are interpreted by the media as signs of guilt and an invitation to dig deeper. In dealing with journalists it is vital that they do not feel they are being manipulated, used to deliver organisational propaganda or 'PR' spin. How open and honest the organisation appears will be central to their reaction and reporting.

It is sound practice to commission some public opinion research or media analysis so you can track changes in public sentiment, and identify those wounds from which you are still bleeding. This will also enable you to monitor how particular media and journalists treat you over time.

Handling adverse reaction

If there is a strong or violent public reaction to a science organisation, even if it is confined to small groups within the community, it is wise to consider the following possibilities.

Attacks on staff

Threats, verbal abuse and even physical attacks may be aimed at the staff of a scientific institution by hostile individuals and groups. The reception desk or switchboard person is often an easy target, as are senior managers and those named publicly as being involved in controversial work. Threats may be delivered by email, mail, phone or in person.

A system for logging all such threats and arranging physical or police security for affected staff must be put in place that can operate at very short notice. All email and written threats should be preserved to assist police inquiries. Staff who are targets of these attacks, or even witnesses to them, will be distressed and may require comfort and counselling.

Attacks on property

Hostile groups may also attack, damage and deface scientific property, particularly if it is not well protected. Sites, vehicles and other property bearing corporate signage are especially vulnerable and ought not to be over-exposed. Property security and surveillance should be reviewed and increased if warranted by the scale of external actions.

Protests

Physical protests, disruption of scientific events on and off-site etc. must also be considered. These can range from harmless but embarrassing incidents (such as nude demonstrations or pie throwing) to highly confrontational incidents. Security at all public, official and media events should be reviewed. Indeed, thought should be given to postponing or cancelling events that offer particular opportunity to protestors.

Local residents may become concerned and angry if a research site in their neighbourhood is targeted by protesters. This may add to the overall volume of external criticism. Steps should be taken to brief local residents and to obtain their views and feedback. In the long-term, their support and tolerance will be critical to the research organisation's presence in the locality.

Electronic attacks

Contemporary protest may take the form of email 'flaming', unauthorised break-ins, computer viral attacks, distribution of offensive material to staff and organised crashing of web servers. Attention must be paid to electronic security, as well as considering what information may be on public display that might inflame negative sentiment.

Political flak

Explanations of the research and its implications may be called for by Government Ministers and officials, and should be ready in advance. Ministers like to be briefed of impending issues before they break.

Oppositions may exploit scientific issues to attack the Government. It is a sensible precaution to brief both sides to avoid one's issue becoming a 'political football'. On many occasions, the local government may also need to be briefed.

Public funding consequences

There may be a loss of public confidence, and hence public funding, as a result of prolonged adverse publicity. A plan to brief and shore up trust among funding sources is highly advisable.

Stakeholder consequences

Consideration should be given to all external stakeholders, including those not directly connected with the research in question, who may develop unease or adverse opinion as a result of prolonged bad publicity. Steps may be needed to reassure and constantly update them. These include commercial partners and other research institutions.

Staff consequences

In managing a crisis, the trust, support and cooperation of staff are of paramount importance. So is keeping them fully informed. Nothing is more damaging than the deliberate leaking of information or rumour-mongering by disillusioned staff who feel ignored, mistrusted or kept in the dark. Junior staff are as important as senior officers – the switchboard operator may receive far more media interrogation and angry public reaction than the Director.

Staff can also assist by acting as a sounding board and a conduit for public opinion. Counselling may be needed for the distressed.

Peer consequences

Harsh judgements and criticism of the institution responsible for the research are likely from scientists and academics in the same as well as unrelated fields, leading to a generally negative professional view of the organisation. The scientific standing of the organisation will need to be considered, and steps taken through professional bodies and scientific publications to restore trust, if needed.

Alienation of supporters

Community groups and non-government organisations that are normally supportive of scientific research may become hostile and angry if they form a view that the work has developed outcomes adverse to their beliefs.

Ethical objections

In a serious controversy, public objections to the research may be expected on religious, moral and ethical grounds, which need to be answered on those grounds. In particular it is important to explain what sort of ethical oversight there was and to demonstrate that community views are both valued and heeded.

Email and web discussion groups

A lot of nonsense and scaremongering is peddled on international email and web discussion groups, and may become a source of self-sustaining attack. It is highly advisable to monitor this discussion and, even at the expense of personal criticism, to seek from time to time to inject the facts, simply and without emotion. Monitoring chat-groups is also a good way to anticipate fresh issues and criticism before they become widespread, and to prepare for dealing with them.

Future conduct of research

A serious public controversy over a piece of science has implications for the future conduct of the research, and of research like it. Issues to be considered include the extent of public oversight, external and government review of the work and its progress. Where public trust is damaged there may be strong political pressure for termination of the work in question.

Damned lies

One of the hardest issues to deal with is the promulgation by critics/opponents of outright falsehoods or cleverly exaggerated claims. The response needs to be:

- calm;
- totally truthful and based on fact;

- always referring to the best interests of the public and community (not those of the institution or the researchers);
- by an experienced and media-skilled senior officer available for comment 24 hours a day;
- endlessly repetitive;
- based on an agreed set of responses that all those involved have, know and understand; and
- short, clear and crisp to meet media requirements.

In managing issues there is no substitute for preparedness. The entire research portfolio should be regularly reviewed for any work with the potential to generate hostile public reaction, even from small segments of the community or lobby groups. In every case identified, a strategy must be devised well in advance for handling the issue if it breaks.

A big problem is that researchers so love their work that they find it incredible, even impossible, to imagine that anyone else would see it as dangerous or unethical, or they feel it is so important that mere criticism ought not to be allowed to stand in its way. Consequently they make poor judges of its potential to provoke controversy in the wider community. Even when they are aware that their work is controversial there is still a great tendency to put heads in the sand and hope that ‘it will never happen’ or to trust that the organisation’s good name will see things through. As scientists may be ill-acquainted with the media and its methods, they may also under-rate the seriousness of an issue and how easily it can spiral out of control.

These are the main reasons why research and academic organisations are poor at issues management. It is therefore very important that the potential of a research project to blow up into an issue or crisis is evaluated by someone who can bring an external perspective – a science communicator, journalist, public relations expert, consumer lobbyist or professional issues manager, even an experienced business person or former politician. If you really want to know what a crisis is, ask someone who has started one!

Eleventh hour attempts to salve a ‘crisis’ can do no more than slightly mitigate, at best, damage to the organisation’s reputation. These attempts are no substitute for early identification and planning.

The most important cultural change needed in a scientific institution wanting to improve its ability to manage issues is to have both management and staff understand that crises are generally an outcome of poor internal practices – not a consequence of attacks by their critics or the media. Shooting the messenger has never been very successful in obliterating the message.

After a crisis

After a crisis it is important for an organisation to understand clearly, if possible, how much damage it has sustained and how this may have affected its standing with key stakeholders, clients, the public and its own staff. This can be done through quantitative and qualitative opinion research and by media analysis, as described in the following chapter.

The next step is to consider how best to repair any damage that may have been sustained to the organisation.

If damage exists among stakeholders and partners, then a methodical process of rebuilding mutual trust and confidence must be set in train. This will invariably involve re-establishing or strengthening personal contacts between the bodies. A series of meetings between managers on both sides is important to understand the nature of the stakeholder's reaction to the issue. Is it a loss of faith in scientific or managerial professionalism, in integrity, or a resentment of having been publicly linked with an unsavoury episode? Only when this understanding is clear can effective efforts be made to re-establish the relationship.

Scientific organisations commonly use the 'deficit model', although not always consciously. In this, the reputation of the organisation is treated as if it were a bank account with a whole series of positive deposits (reported achievements) over time adding up to a healthy balance. Along comes a crisis and there is a sudden withdrawal of the organisation's 'savings' of good standing. If the crisis is serious enough, the account goes into the red, meaning that the overall external perception of the institution is a negative one and it is in deficit. Even very ancient and august establishments, like the great old universities, are no more immune from a negative balance of public perception than an ancient banking house is immune from bankruptcy.

This model must not replace proactive issues management as a way of dealing with negative sentiment, because good planning can dramatically reduce the extent of the withdrawal of one's credit balance.

However, where the institution is seen to have suffered a loss of credit, great or small, then the intelligent course is to redouble its efforts to get some positive information back into the public arena. This may involve listening carefully to the tone of public criticism, and providing examples of the organisation's work that will offset it.

The 10-to-1 rule says that if you have had 10 bad stories published in the media about you, you will need to aim for 100 positive stories before you can hope to offset the impact. In practice, it may take several years of consistent hard work to overcome the negative impact of a particularly serious issue on your credit balance. The full cooperation of your scientists and communicators will be needed to increase organisational output of information beneficial to the public.

This may sound a little self-serving, but one of the positive things about having a crisis is that it prompts a certain amount of internal questioning and this may lead to a recognition of the need to be more open, communicative and heedful of public opinion and to factor public benefit into research planning more consistently.

External communication then becomes more closely attuned to the public's needs and interests, rather than the organisation's, and so becomes a more effective form of knowledge sharing.

As important as addressing external trust is the need to repair any internal loss of confidence that may have occurred. After a crisis, extra effort is required to convince skeptical staff that management has listened and learned from the event and is prepared to change its behaviour where needed.

Image and brand management

There is much confusion among scientific and academic institutions about the need for corporate image or brand management. A good many fall prey to commercial spin-doctors and image-merchants who will charge hundreds of thousand dollars for a report telling the institution what it probably knew, collectively, in the first place and that will leave it little the wiser as to how to go about improving the situation (unless, of course, it hires the image crafters at a further massive cost).

The confusion arises from the fact that universities and research agencies are engaging in more and more contract work for the private sector. They are learning the language, mode of thought and ways of commerce as they get closer to their customers. This is laudable and necessary. Where error creeps in is in the assumption that what is right for commerce in general is also right for science or academia.

It is, of course, essential for a scientific or academic body to have a high reputation, a clear identity and a prominent and trusted brand. These are at the heart of its ability to attract good staff, plentiful funding and to achieve the ultimate adoption or commercialisation of its research.

Truth beats fiction

The core issue is whether the image is based upon genuine merit and unique attributes or whether it is a synthetic one derived from clever but shallow publicity, spin-doctoring, advertising, self-promotion and other highly commercial techniques. The risk in the latter course is that the public are not fools, and can soon spot a 'show pony' from a genuine stayer.

In commerce, whether you make breakfast cereal or toothpaste or deliver banking services, you are one company among many offering similar products. It is vital to try to differentiate your product from your competitors', even if it isn't really all that different. That's where good marketing, PR and corporate image-building come in.

The situation is different for science and academia. Although scientific and academic institutions may perceive themselves as being in commercial competition with one another for research work or for students, in reality their products are usually quite distinctive. Scientific research, in particular, is unique because that is the special feature of scientific discovery, peer review and reporting. Research that isn't unique is plagiarism.

To reiterate the principle, the corporate image or brand of a scientific institution rests not on artificial promotion but on the communication of its real achievements over time.

The best way to build and sustain its image is for the organisation to communicate the outcomes of its research and their value to society or industry as effectively, comprehensively and truthfully as possible. There is no need to embellish: scientific excellence speaks for itself, although it may require clear explanation to some audiences.

Many institutions appear to forget this and embrace – at considerable cost – the techniques that work for breakfast cereals, toothpaste or banking services. Apart from being a disservice to human knowledge and its sharing, this also betrays a lack of confidence in the real value of their own work. It is tantamount to a confession that their work is so indistinguishable from that of their competitors that it needs gratuitous promotion.

Listening skills

The second key ingredient in the successful image management of a scientific organisation is to have highly developed listening skills that enable it to hear and understand what is going on in the world outside. In many cases this will mean assigning trained staff specifically to the task of carrying out opinion research, obtaining feedback, talking with clients and monitoring public debate.

In the traditional model – far too common still, alas – the organisation goes about its business with absolute concentration and focus, ignoring the outside world and then being surprised when it finds itself out of step or facing a crisis. Like a piece of emergency equipment in a glass case, the communicator is assigned a subsidiary role – 'do what the scientists tell you' – rather than being a key part of the management team advising and planning the external profile. Classically, if there's a crisis they smash the communicator's glass case, tell her or him to get out and 'fix it', and then blame them when the attempt fails.

It may seem odd, in speaking of a research organisation, but the major failure here is one of research. Not enough is known about what is happening in the outside world, and the institution has become out of touch and, fallen behind changes in politics or community expectations, standards and demands. Essential to having the world think well of you is to understand what the world sees when it looks at you. Almost certainly it will be different to what you imagine.

George Littlewood, an internationally experienced public affairs manager for the mining industry, says that one of the reasons the miners came in for so much criticism in the latter 20th century was that they were slow to appreciate how people's understanding of and care for the environment had grown. The miners had assumed the public mainly wanted them to create wealth and jobs, so they didn't need to bother too much about issues such as relations with the community, native peoples and the environment. It wasn't until they did detailed qualitative opinion research that the miners discovered, with a shock, that the public wanted them to do better in *all* areas, *at the same time*.[1]

'Community and government expectations will change over time, and there is a danger for your organisation in your performance shifting too far from their expectations,' Littlewood says. This creates what he terms a 'legitimacy gap', which falls between the organisation and the public sanction it has to do scientific research. If the gap spreads wide enough, that sanction may be withdrawn.

The two ways to close the gap, and ensure the organisation is valued and has high approval, are:

- to improve the way it communicates with and engages various audiences; and

- to change its behaviour so it resonates far more in tune with changing community expectations and requirements, and understands them better.

Silly names and logos

The identity of a scientific institution is comprised of four things: its purpose, achievements, name and imagery.

A concern with corporate identity – in the sense of the organisation's name, crest, livery, logo, letterhead, signage, publications and so on – is sensible. Consistency and repetition are important elements of effective communication and image projection. However, a common error is for organisations to adopt names, symbols or imagery that are internally meaningful but externally ambiguous, opaque or just plain bizarre.

Scientific organisations are especially prone to this vice. Their delight in long, complicated, specialised and obscure names may describe their field of expertise to the cognoscenti but the other 99.9 per cent of the human race – the ones who generally pay scientists' wages or will ultimately use their products – are left completely in the dark. While that might not seem to matter much to the internal corporate egos, in reality it obstructs the work of raising funds, finding industry partners, communicating and obtaining public recognition of the work. It also conveys an impression of secretiveness and arrogance.

We have encountered many scientific bodies infuriated because the media left their name out of a report or else cut it short, and who look completely nonplussed when you tell them that is what the media does with silly names. It is far more concerned with the substance of the story and what it means to readers than with tedious names.

If yours is a new scientific organisation and you have the privilege of devising its identity, name and symbols, then a sensible course is to consult with the likely customers and stakeholders as well as the staff and management. If, on the other hand, the organisation carries a long and burdensome title from yesteryear that for various reasons, both reputational and sentimental, it is unwilling to relinquish, it is still possible to coin a working title, a public brand or slogan that better explains what the organisation actually does.

A good example of this is the World Bank. The actual name is the International Bank for Reconstruction and Development (IBRD) but everyone calls it the World Bank because it is short, neat and conveys the idea that it is global and has something to do with money. Another example is a fish research institute, the International Centre for Living

Aquatic Resources Management (ICLARM), which wanted to raise its public profile without abandoning a respected professional name – so it selected a brand, *WorldFish*, to use in conjunction with the formal name. Likewise the Consultative Group on International Agricultural Research (CGIAR) is a name obscure to those outside certain specialist circles. For this reason it adopted the brand *Future Harvest* for its public awareness and fund-raising activities. It did this after testing the name on the public and finding that they understood from it that the work of the CGIAR was chiefly about ensuring the future of the global food supply.

Just as parents can curse a child for life with an ill-advised choice of name, the same is true of scientific organisations. A bad decision is an albatross around their neck. It is very important for a name to reflect the values of those within an organisation – but it should also be a name that sends the right signals to those outside. The best plan is to test internally-proposed names out on various audiences outside the institution using focus group or similar techniques, and seeing how they react not only to the full title but also to its component words, as well as what images the name conjures up. This can sometimes be quite a shock!

This also applies to logos. What may be aesthetically appealing, or a clever embodiment of key institutional elements, can also create public mystification and confusion – especially if it has unfortunate connotations outside science. While the authors have nothing against aesthetics, they advise the choice of a logo that conveys something informative to the outside world. Good design always embodies function as well as form. In this respect, the heraldry of older universities has more going for it, in terms of words and symbols, than much modern graphic art (except for the dwindling number of people capable of translating the Latin motto).

Chapter 12

Learning to listen

This book has stressed the importance of understanding one's public, listening to their views and values, obtaining feedback and measuring the effectiveness of one's communication activities. These are things that commercial and political organisations do as a matter of course, and think nothing of spending millions of dollars on them. They appreciate their value. Science, the great measurer, largely does not.

Scientific organisations rarely devote more than a tiny fraction of one per cent of their resources to this vital activity, which is a strategic error if the goal is to share knowledge more widely, assist the smooth commercialisation or adoption of research findings, build external trust and increase investment in science. In the 21st century the old, didactic 'science knows best' model of knowledge delivery is no longer very workable, and in educated democracies is becoming less and less so.

Since funds for opinion research and science communication are invariably tight, the purpose of this chapter is to explore low-cost but effective means to obtain feedback from various audiences, measure their responses and better understand external perceptions of your institution and its work. Just as most of us would have trouble in recognising ourselves from a rear view, many scientific bodies find their external image quite unfamiliar and strange to begin with.

Nothing beats face-to-face feedback and exchange of information. However, this only includes a limited number of sources, is time-consuming and can produce distorted results based on what the individuals select from what they are told. Science managers seeking feedback may come back from a foray into the outside world laden with what they wanted to hear. Feedback obtained in this way should always be compared with an objective source, such as data from opinion research with various key audiences.

One of the most cost-effective ways to obtain feedback on an institution and its work is what we term 'trilateral' research. This presents three separate, but interlinked, perspectives of the organisation and consists of:

- quantitative research across large samples of the population and specific target groups;

- qualitative (focus group) research using smaller representative groups to help interpret the numerical data obtained from the first method and to identify perceptions, ethics and values; and
- media analysis, which looks at the image of the organisation and its work as presented to the public and key target audiences through mass, specialist and local media.

Both quantitative and qualitative research can be carried out among the general populace or in specific groups such as customers, partners, decision-makers and opinion leaders. It is highly desirable to do both to generate both macro and micro views of the organisation, issues of concern and needs.

Scientific organisations generally have little difficulty with the notion that industry has specialist knowledge that needs to be exchanged with researchers in order to produce a satisfactory partnership and research outcome. However, they may find difficulty with the notion that the community at large has special knowledge that is essential to the science process. Yet it does. This ‘knowledge’ is embodied in community views, morality, needs, perceptions, traditions, fears and concerns – all highly unscientific things on the surface (though they have kept humanity going for a million years or so), but failure to access them may well produce a misfit between science and society, a loss of credibility on the one hand and trust on the other, not to mention a big waste of research funds and scientists’ time.

This is one source of the growing crisis of public trust in science remarked in many recent scholarly studies,[1] and of the paradox that the increasing commercialisation of science appears to be accompanied by decreasing public confidence in it. One way to address this it is to use the theory, propounded in Chapters 5 and 8 of the proximate and ultimate customers of science – the proximate being the company or government that immediately receives the research outcome, and the ultimate being the consumer or the wider community who (sometimes) is the ultimate user or beneficiary.

If they hope to get it right, science organisations need to be highly attuned to both customers: they need to ‘listen with both ears’, not merely with one. They need to accept that knowledge and expertise reside in the wider community, as well as in industry. They need to recognise the public as partners in the innovation and knowledge-sharing process.

Furthermore, if they understand what it is that consumers or the public want and believe, they are far more likely to be helpful to industry in achieving a commercially successful research outcome and to be a truly constructive partner. On occasion they also need the fiscal guts to tell industry that some technological advance it wants is unacceptable from a consumer perspective.

Quantitative research

Quantitative research is best known as opinion polling or public opinion research. It is normally carried out by professional pollsters and market research companies, and sometimes by the sociology and politics departments of universities. It consists of a series of simple questions – usually with yes/no or good/bad answers – that yield a numerical result such as '75 per cent of the population has heard of your institution (men 78 per cent, women 73 per cent), but only 15 per cent know of your work in food research or marine biology'.

The advantage of this technique is that, for a comparatively moderate cost, it can give you a snapshot of what the population, or subsets of it, knows and does not know about your organisation and its work, and how highly they esteem it. The most efficient way to use this technique is to employ a professional pollster and to tack your questions on to the end of the regular questions they ask of the population like 'Who do you intend to vote for?' and 'What make of new car do you plan to buy?' The cost of doing this varies according to the number of questions you pose, but is usually not high unless you commission exclusive research. It has the great advantage of using a well-characterised sample of the general population, as small as a few thousand individuals, that is continually being checked and refined for its representitiveness.

Questions a science organisation might pose are:

- have you ever heard of (name of your organisation)?
- which of the following areas of science do you associate them with (list your fields)?
- how would you rate their work (very good/good/satisfactory/poor/bad)?
- do you approve/disapprove of scientific research in… (a controversial field)?

Opinions derived from such polling can be analysed according to gender, age cohort, geographic locality, income group etc.

As a one-off, this sort of information may not appear very useful except to let you know where you stand. Repeated at regular intervals, however, it soon gives a clear idea of whether public awareness of your work is growing or declining, approval is rising or falling, where you need to concentrate greater effort and more resources, and what issues may be brewing – in short the basic information needed to help you fine-tune your awareness and knowledge-sharing strategy.

As a cross-check, it is advisable to include the same questions in polling of important groups – clients of the organisation in various industries and sectors, politicians, media editors, public opinion leaders, senior bureaucrats and the like. These groups both lead and follow general public opinion, and any differences can be meaningful.

Quantitative analysis also has the virtue of providing a basic statistical underpinning for the communication and awareness function, a way of monitoring and reporting its effectiveness as evidence to persuade scientific management that it is a sound investment.

Qualitative research

Qualitative (or focus group) research is one of the most valued techniques in the marketing industry for understanding how consumers will react to a new product, the positioning of a brand and so on. Science organisations tend to shy away from it because its data is 'soft' and non-numerical. Yet it reveals an extraordinary range of emotional, psychological, intellectual, educational and cultural issues that go into forming public opinion, trust, a decision to accept or not to accept a particular technology or science product.

One of the most valuable experiences the management of a scientific institution can have is simply to sit and listen to a group of 'ordinary citizens', unbriefed and not particularly scientifically literate, discussing the institution and its work. It can bring them back to social and political reality in a way that mere statistics cannot.

A focus group is a discussion among a representative bunch of citizens of a topic of interest to the body that commissions it. Although the discussion may be facilitated, the best approach is not to pose questions but rather to let conversation flow among the group on the general topic, allowing them to show what they do and do not know and how they feel about an issue. The results can be presented in a statistical way, but as the sample size is small – generally a dozen or so people in a group, with a limited number of groups – it is wise not to place too much reliance on this. A cross-check with your numerical survey will tell you whether the focus group accurately reflects common opinion.

However, what you are really after are comments, remarks, criticisms, quotes, ideas, (mis)conceptions and moral and values statements – the things that tell you what the people are really thinking. George Littlewood recounts how the mining industry misled itself by relying only on statistics indicating that the public rated its economic role above its social or environmental responsibilities. The industry rested on its laurels until focus research revealed the shocking truth that the public really expected a high commitment to all three. Focus work lets you see and understand things that aren't in the raw figures.

Another highly relevant example of this are the five successive opinion polls taken in Australia over a decade which show the public to be more interested in science stories in the media than they are in politics, economics, crime or employment. On the surface this might be taken as a very positive sign for science. However, when the qualitative work is done, it emerges that many of these people are actually frightened of science and the changes it is bringing to their lives; they are resentful of technology rather than excited by it. Thus their high 'interest' in science may be more of a morbid apprehension than an enthusiasm. Of course, this only applies to a percentage of people but nevertheless it is an issue to be borne in mind when developing a science awareness or outreach program: some people find science fascinating while others regard it as threatening.

Another use for focus research is in the naming of scientific institutions and programs. What seems like a perfectly sensible professional title within the discipline may send all sorts of confusing or alarming signals to the community, and you'd never know it until it was too late. Worst of all, it may send signals that you are arrogant, remote, aloof, disinterested in community values, tuned-out, irrelevant – and not worth investing in. What ordinary citizens think may seem of small importance but, sooner or later, it is reflected in what politicians think too.

Media analysis

Media analysis is an increasingly refined and useful tool for monitoring a scientific institution's overall image, as presented to society or segments of the community, through the media. It is particularly useful for tracking issues over time and judging how the climate of popular opinion is evolving. Its greatest value, however, lies in the ability it confers to fine-tune external awareness strategy and tactics, right down to the level of local media and individual journalists. It is a first-rate way of staying flexible and in touch.

To appreciate the value of media analysis requires the institution to have a reasonably sophisticated understanding of the media – to grasp that what appears in it is not there merely because of journalistic whim but because society applies market pressure to the media to run certain sorts of stories. The media, in other words, is a mirror of society, often close to the leading edge of shifts in public opinion but also rarely actually inspiring them because it is unwise in a business sense for it to get too far ahead of its market. The reason for science to analyse its presence in the media is to help it understand not only how it is being presented to the community, but also where the leading edge of public debate is heading so that research can keep closely in touch and stay relevant.

Media analysis not only quantifies the organisation's presence in the media (number of stories, length, financial value, source) but also assesses their quality. This is a complex art, for which there are various different formulae, but basically it involves a combined assessment of:

- the quality of the medium in which the story appeared and its audience reach;
- the position within the medium (e.g. an early newspaper page or the 'back of the book'; the 6 o'clock news or a midnight chat show);
- the nature of the overt and implicit messages that appeared in the story (did it convey the desired message to the audience?); and
- factors that influenced readership or audience reach (e.g. position on the page or in the program, accompanying visual material, reputation of the journalist, editorial treatment, headline etc.).

The data also reveal who are your most active and effective spokespeople and critics; which media give you the most prominent or sympathetic coverage and which the poorest run; which journalists are most supportive or critical; which issues are bringing credit to you, and which disrepute; and what are the messages most commonly presented about your work through the media.

Media analysis helps you to understand the origin of shifts in public opinion discernible in opinion polling or focus groups. For example, one science agency knew from opinion research it had high awareness in one city and declining awareness in another. It turned out that the leading daily newspaper in the city with poor awareness had a low coverage of science, and this immediately prompted a refocusing of communication strategy to try to address the problem.

In an even more cogent example, successive polls over a number of years revealed declining science awareness and interest among people aged 14–24 years. Media analysis showed that most of the science coverage was in print media, but young people simply weren't reading newspapers like their parents had done. Instead they were getting their science from TV, radio and the web. This prompted a major shift in communication tactics to target the electronic media. The same research also highlighted flaws in science teaching and awareness in the education system.

Media analysis is also invaluable to effective issues and crisis management. Not only does an institution confronting a crisis need to know *what* is being said in the media on a daily basis, it also needs a more objective measure of how the issue is developing than one can get just by scanning headlines. Media analysis provides an index of favourability or unfavourability, both for the organisation as a whole and for a particular issue. It will reveal what are the positive or negative messages about your organisation emerging from the coverage; it will also give you a better idea of how prominently the issue is being presented, which helps you to react in proportion (and avoid over-reaction). It tells you which journalists and media you need to build better relationships with. Long-term, it can tell you when an unfavourable issue has finally slipped out of public consciousness or been replaced by a more positive image.

Customer value analysis

Customer value analysis (CVA) is one of the more business-oriented methods for assessing the value that proximate customers see in and obtain from a science organisation. It can be applied to virtually any immediate client group – industrialists, service providers, government, farmers, health care workers, environmentalists and so on.

It may employ a spectrum of both quantitative and qualitative tools from questionnaires to face-to-face interviews, web surveys and focus groups, and range from medium cost and broad spectrum to expensive and highly targetted. Its greatest strength is the focus on client needs, especially the form in which they want new knowledge and technology delivered. Its primary concern is with producing as seamless a 'fit' as possible between science provider and immediate science user.

Questions posed to the customer typically ask them to rate, and comment on, the price and quality of such features of the research provider and the partnership as:

- level of expertise;
- application of relevant skills;
- quality of facilities and equipment;
- quality of science;
- quality of service;
- understanding of the customer's requirements;

- handling of the contract;
- pricing;
- value for money;
- effective use of the client's time;
- delivery on time and on budget;
- handling of complaints;
- meeting the client's requirements;
- communication of the results;
- overall satisfaction;
- rating of other competing research providers; and
- willingness to use the organisation again.

Like all forms of market research, CVA needs to be conducted regularly to be of most value, in order to pick up trends in the relationship. The drawback for science organisations is the cost of doing this sort of research frequently (including client annoyance), and their possible lack of flexibility in responding to what it tells them. To be run on a regular basis it is necessary to show that the investment in CVA is repaid in the form of new income or business.

As discussed in Chapter 5, it is highly desirable to compare the findings of CVA with broader forms of public opinion research, especially with quantitative and qualitative research among opinion leaders (who may not necessarily be clients of the organisation) and among consumers, in order to be confident that the feedback is really going to achieve the desired goal of sharing knowledge more effectively with the community. Believe it or not, commercial firms can be as out of touch with community sentiment and consumer requirements as research institutions, and it is sensible to cross-check with the ultimate consumers.

Reputational analysis

Reputational analysis (RA) is a comparatively new device in the market research toolbox, and relates in particular to the need of companies and organisations to be able to measure the good standing of their brand in the wider community and with particular key groups of stakeholders.

It is an evolution of brand valuation, which in its original form was focused chiefly on monetary value (as expressed by turnover, share price etc.) but which grew to embody a range of other less tangible though no less important values affecting overall corporate performance.

In the 'triple bottom line' era, when the performance of companies and institutions is also judged by social, environmental and ethical criteria as well as fiscal results, RA is becoming quite popular with larger corporations. It reflects an understanding that the financial outcome can be seriously affected by poor performance in, say, the environmental area or by an appearance of unethical or unfeeling behaviour. The same applies to research institutions, whose funding not only depends upon having strong science projects and good staff but also upon the image they project for trustworthiness and attunement to community views and values.

In its fuller forms RA is detailed and expensive, and probably beyond the means of most scientific organisations unless they are large, generously-funded or are experiencing significant image problems that need to be well understood so they can be better managed.

The RA process seeks to:

- identify and analyse factors that contribute to the institution's public reputation, good or poor;
- identify stakeholder groups and opinion leaders who are important in the establishment of a sound reputation;
- analyse current and future risk factors that may affect the organisation's good standing with various stakeholders; and
- create a 'reputation profile' that lets the organisation measure itself in terms of its ability to meet stakeholder standards and expectations.

Some forms of RA allow an organisation to track its standing directly against its competitors and see who's ahead in the image stakes. However, there must be a lot of institutions taking part in the survey for this to be informative. Others place the accent on measuring the organisation's reputational performance according to criteria it has set itself. This is probably the more useful, as it lets a body judge whether it is succeeding or failing by its own standards and ideals.

Like other forms of opinion research, RA involves putting questions to influential individuals and organisations across the community – such as peak industry councils, environmental bodies, religious organisations, government institutions, professional groups and so on. The answers are collected and analysed and may be consolidated, if desired, in a reputation index that can move up and down just like a financial credit rating. The kinds of issues that can be measured include:

- value to customers;
- value to the community;

- value to funders and investors;
- quality of management;
- social impact;
- environmental impact;
- ethical standards;
- external communication; and
- staff relations.

The outcomes of RA for science include greater external investment, more partners, more rapid and effective adoption of results, greater public transparency and trust, and greater attractiveness to scientific talent.

An important feature of RA is posing the same questions to staff internally. This reveals whether there are major gaps and inconsistencies between self-image and external image. For example, the staff may regard their outfit as highly ethical on balance but the wider community, reacting to one or two unsavoury events that were widely publicised, may award a far lower score. When such perceptions flow into reduced research funding or lower uptake of an organisation's knowledge output, it can be sure it is in trouble.

Conclusion

Although other effective methods for communicating with stakeholders exist, in particular the creation of standing advisory committees, the ones described above share the virtues of being relatively inexpensive and effective. However, the best opinion research in the world is of scant value unless the organisation is willing to listen.

The most important strategic ingredient in a 21st century scientific organisation is the ability to listen to the outside world – to clients and stakeholders but also to large audiences including government and the community, minorities, native peoples, regional and interest groups.

The future of science depends on its ability to shape itself to the needs, values and standards of humanity.

The future of humanity depends on a science that is open, listening and committed to overcoming the inequities and inequalities caused by the uneven sharing of knowledge or its misapplication.

Key messages

These are some of the key messages from the text of *Sharing knowledge*.

- Knowledge is the common heritage of all people.
- The sharing of knowledge is as important as its discovery.
- Science must engage the community in a dialogue, each recognising the other as an equal partner in human advancement.
- Partnership between all nations, developed and developing, in knowledge sharing is central to the peace, well-being, health and sustainability of humanity.
- The public reputation of a scientific institution and its staff rests on the effective communication of its real achievements.
- In a science communication plan, the key message must be drawn from the perspective of the research user, not the research producer.
- Scientists trust numbers more than they do words or images.
- To achieve optimal awareness of its value to society, a scientific institution should seek recognition for all of its work, not simply for a part of it.
- Whining will not generate greater support for science – but telling a good, accurate story about your research in a compelling and relevant way will.
- Partnership between science and the media is essential to an advancing society.
- The media is a primary audience for science because it reaches all the other audiences – decision-makers, opinion leaders, professionals, industry, partners, other researchers and the community at large.
- The journalist and the scientist are partners in the process of knowledge generation and sharing. Each can add value to the other's work.
- A scientific organisation that is serious about sharing its knowledge, building its profile and attracting research funding will ensure media training for key spokespeople.
- The key to an effective partnership between science and politics is for scientists and their managers to develop a better insight into the way the political mind and process works, and then fit or interpret their research findings according to its needs.

- Private industry is one of the most effective and valuable means for science to share its knowledge with the community, the nation and the world at large.
- Enlightened companies will come to see it as their role and their responsibility, as world citizens and as astute investors, to help to share knowledge among the poorest of the poor and among those who lack easy access to information they can use.
- The successful commercialisation of science requires the institution and its scientists to get inside industry's head.
- Excessive secrecy, or simply a failure to communicate, will tend to reinforce public suspicions about the motives and ethics of scientific institutions.
- One of the keys to scientific and technological advancement is to engage both facets of the human character – the innately adventurous and the innately cautious.
- The fact that scientists have been criticising themselves and each other for failure to communicate with society for most of the 20th century and into the 21st suggests that something is wrong.
- An organisational crisis is an outcome of poor planning and bad management on the part of the research organisation and *not* a consequence of attacks by critics or the media.
- The golden rules of issues management are:
    1. *The public interest is paramount.*
    2. *There is an absolute commitment to openness and honesty.*
- The corporate image or brand of a scientific institution rests not on artificial promotion but on the communication of its real achievements over time.
- The future of science depends on its ability to shape itself to the needs, values and standards of humanity.
- The future of humanity depends on a science that is open, listening and committed to overcoming the inequities and inequalities caused by the uneven sharing of knowledge.

Appendix

Declaration on science and the use of scientific knowledge

Text adopted by the World Conference on Science, 1 July 1999.

Preamble

1. We all live on the same planet and are part of the biosphere. We have come to recognise that we are in a situation of increasing interdependence, and that our future is intrinsically linked to the preservation of the global life-support systems and to the survival of all forms of life. The nations and the scientists of the world are called upon to acknowledge the urgency of using knowledge from all fields of science in a responsible manner to address human needs and aspirations without misusing this knowledge. We seek active collaboration across all the fields of scientific endeavour, that is the natural sciences such as the physical, earth and biological sciences, the biomedical and engineering sciences, and the social and human sciences. While the Framework for Action emphasises the promise and the dynamism of the natural sciences but also their potential adverse effects, and the need to understand their impact on and relations with society, the commitment to science, as well as the challenges and the responsibilities set out in this Declaration, pertain to all fields of the sciences. All cultures can contribute scientific knowledge of universal value. The sciences should be at the service of humanity as a whole, and should contribute to providing everyone with a deeper understanding of nature and society, a better quality of life and a sustainable and healthy environment for present and future generations.
2. Scientific knowledge has led to remarkable innovations that have been of great benefit to humankind. Life expectancy has increased strikingly, and cures have been discovered for many diseases. Agricultural output has risen significantly in many parts of the world to meet growing population needs. Technological developments and the use of new energy sources have created the opportunity to free humankind from arduous labour. They have also enabled the

generation of an expanding and complex range of industrial products and processes. Technologies based on new methods of communication, information handling and computation have brought unprecedented opportunities and challenges for the scientific endeavour as well as for society at large. Steadily improving scientific knowledge on the origin, functions and evolution of the universe and of life provides humankind with conceptual and practical approaches that profoundly influence its conduct and prospects.

3. In addition to their demonstrable benefits the applications of scientific advances and the development and expansion of human activity have also led to environmental degradation and technological disasters, and have contributed to social imbalance or exclusion. As one example, scientific progress has made it possible to manufacture sophisticated weapons, including conventional weapons and weapons of mass destruction. There is now an opportunity to call for a reduction in the resources allocated to the development and manufacture of new weapons and to encourage the conversion, at least partially, of military production and research facilities to civilian use. The United Nations General Assembly has proclaimed the year 2000 as International Year for the Culture of Peace and the year 2001 as United Nations Year of Dialogue among Civilisations as steps towards a lasting peace; the scientific community, together with other sectors of society, can and should play an essential role in this process.

4. Today, whilst unprecedented advances in the sciences are foreseen, there is a need for a vigorous and informed democratic debate on the production and use of scientific knowledge. The scientific community and decision-makers should seek the strengthening of public trust and support for science through such a debate. Greater interdisciplinary efforts, involving both natural and social sciences, are a prerequisite for dealing with ethical, social, cultural, environmental, gender, economic and health issues. Enhancing the role of science for a more equitable, prosperous and sustainable world requires the long-term commitment of all stakeholders, public and private, through greater investment, the appropriate review of investment priorities, and the sharing of scientific knowledge.

5. Most of the benefits of science are unevenly distributed, as a result of structural asymmetries among countries, regions and social groups, and between the sexes. As scientific knowledge has become a crucial factor in the production of wealth, so its distribution has become more inequitable. What distinguishes the poor (be it people or countries) from the rich is not only that they have fewer assets, but

also that they are largely excluded from the creation and the benefits of scientific knowledge.

6. We, participants in the World Conference on Science for the Twenty-first Century: A New Commitment, assembled in Budapest, Hungary, from 26 June to 1 July 1999 under the aegis of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Council for Science (ICSU):

Considering:

7. where the natural sciences stand today and where they are heading, what their social impact has been and what society expects from them,
8. that in the twenty-first century science must become a shared asset benefiting all peoples on a basis of solidarity, that science is a powerful resource for understanding natural and social phenomena, and that its role promises to be even greater in the future as the growing complexity of the relationship between society and the environment is better understood,
9. the ever-increasing need for scientific knowledge in public and private decision-making, including notably the influential role to be played by science in the formulation of policy and regulatory decisions,
10. that access to scientific knowledge for peaceful purposes from a very early age is part of the right to education belonging to all men and women, and that science education is essential for human development, for creating endogenous scientific capacity and for having active and informed citizens,
11. that scientific research and its applications may yield significant returns towards economic growth and sustainable human development, including poverty alleviation, and that the future of humankind will become more dependent on the equitable production, distribution and use of knowledge than ever before,
12. that scientific research is a major driving force in the field of health and social care and that greater use of scientific knowledge would considerably improve human health,
13. the current process of globalisation and the strategic role of scientific and technological knowledge within it,
14. the urgent need to reduce the gap between the developing and developed countries by improving scientific capacity and infrastructure in developing countries,

15. that the information and communication revolution offers new and more effective means of exchanging scientific knowledge and advancing education and research,
16. the importance for scientific research and education of full and open access to information and data belonging to the public domain,
17. the role played by the social sciences in the analysis of social transformations related to scientific and technological developments and the search for solutions to the problems generated in the process,
18. the recommendations of major conferences convened by the organisations of the United Nations system and others, and of the meetings associated with the World Conference on Science,
19. that scientific research and the use of scientific knowledge should respect human rights and the dignity of human beings, in accordance with the Universal Declaration of Human Rights and in the light of the Universal Declaration on the Human Genome and Human Rights,
20. that some applications of science can be detrimental to individuals and society, the environment and human health, possibly even threatening the continuing existence of the human species, and that the contribution of science is indispensable to the cause of peace and development, and to global safety and security,
21. that scientists with other major actors have a special responsibility for seeking to avert applications of science which are ethically wrong or have an adverse impact,
22. the need to practise and apply the sciences in line with appropriate ethical requirements developed on the basis of an enhanced public debate,
23. that the pursuit of science and the use of scientific knowledge should respect and maintain life in all its diversity, as well as the life-support systems of our planet,
24. that there is a historical imbalance in the participation of men and women in all science-related activities,
25. that there are barriers which have precluded the full participation of other groups, of both sexes, including disabled people, indigenous peoples and ethnic minorities, hereafter referred to as disadvantaged groups,
26. that traditional and local knowledge systems, as dynamic expressions of perceiving and understanding the world, can make, and historically have made, a valuable contribution to science and technology, and that there is a need to preserve, protect, research and promote this cultural heritage and empirical knowledge,

27. that a new relationship between science and society is necessary to cope with such pressing global problems as poverty, environmental degradation, inadequate public health, and food and water security, in particular those associated with population growth,
28. the need for a strong commitment to science on the part of governments, civil society and the productive sector, as well as an equally strong commitment of scientists to the well-being of society,

Proclaim the following:

1 Science for knowledge; knowledge for progress

29. The inherent function of the scientific endeavour is to carry out a comprehensive and thorough inquiry into nature and society, leading to new knowledge. This new knowledge provides educational, cultural and intellectual enrichment and leads to technological advances and economic benefits. Promoting fundamental and problem-oriented research is essential for achieving endogenous development and progress.
30. Governments, through national science policies and in acting as catalysts to facilitate interaction and communication between stakeholders, should give recognition to the key role of scientific research in the acquisition of knowledge, in the training of scientists and in the education of the public. Scientific research funded by the private sector has become a crucial factor for socio-economic development, but this cannot exclude the need for publicly funded research. Both sectors should work in close collaboration and in a complementary manner in the financing of scientific research for long-term goals.

2 Science for peace

31. The essence of scientific thinking is the ability to examine problems from different perspectives and seek explanations of natural and social phenomena, constantly submitted to critical analysis. Science thus relies on critical and free thinking, which is essential in a democratic world. The scientific community, sharing a long-standing tradition that transcends nations, religions and ethnicity, should promote, as stated in the Constitution of UNESCO, the 'intellectual and moral solidarity of mankind', which is the basis of a culture of peace. Worldwide cooperation among scientists makes a valuable and constructive contribution to global security and to the development of peaceful interactions between different nations, societies and

cultures, and could give encouragement to further steps in disarmament, including nuclear disarmament.

32. Governments and society at large should be aware of the need to use natural and social sciences and technology as tools to address the root causes and impacts of conflict. Investment in scientific research which addresses them should be increased.

3 Science for development

33. Today, more than ever, science and its applications are indispensable for development. All levels of government and the private sector should provide enhanced support for building up an adequate and evenly distributed scientific and technological capacity through appropriate education and research programmes as an indispensable foundation for economic, social, cultural and environmentally sound development. This is particularly urgent for developing countries. Technological development requires a solid scientific basis and needs to be resolutely directed towards safe and clean production processes, greater efficiency in resource use and more environmentally friendly products. Science and technology should also be resolutely directed towards prospects for better employment, improving competitiveness and social justice. Investment in science and technology aimed both at these objectives and at a better understanding and safeguarding of the planet's natural resource base, biodiversity and life-support systems must be increased. The objective should be a move towards sustainable development strategies through the integration of economic, social, cultural and environmental dimensions.

34. Science education, in the broad sense, without discrimination and encompassing all levels and modalities, is a fundamental prerequisite for democracy and for ensuring sustainable development. In recent years, worldwide measures have been undertaken to promote basic education for all. It is essential that the fundamental role played by women in the application of scientific development to food production and health care be fully recognised, and efforts made to strengthen their understanding of scientific advances in these areas. It is on this platform that science education, communication and popularisation need to be built. Special attention still needs to be given to marginalised groups. It is more than ever necessary to develop and expand science literacy in all cultures and all sectors of society as well as reasoning ability and skills and an appreciation of ethical values, so as to improve public participation in decision-making related to the application of new knowledge. Progress in

science makes the role of universities particularly important in the promotion and modernisation of science teaching and its coordination at all levels of education. In all countries, and in particular the developing countries, there is a need to strengthen scientific research in higher education, including postgraduate programmes, taking into account national priorities.

35. The building of scientific capacity should be supported by regional and international cooperation, to ensure both equitable development and the spread and utilisation of human creativity without discrimination of any kind against countries, groups or individuals. Cooperation between developed and developing countries should be carried out in conformity with the principles of full and open access to information, equity and mutual benefit. In all efforts of cooperation, diversity of traditions and cultures should be given due consideration. The developed world has a responsibility to enhance partnership activities in science with developing countries and countries in transition. Helping to create a critical mass of national research in the sciences through regional and international cooperation is especially important for small States and least developed countries. Scientific structures, such as universities, are essential for personnel to be trained in their own country with a view to a subsequent career in that country. Through these and other efforts conditions conducive to reducing or reversing the brain drain should be created. However, no measures adopted should restrict the free circulation of scientists.

36. Progress in science requires various types of cooperation at and between the intergovernmental, governmental and non-governmental levels, such as: multilateral projects; research networks, including South–South networking; partnerships involving scientific communities of developed and developing countries to meet the needs of all countries and facilitate their progress; fellowships and grants and promotion of joint research; programmes to facilitate the exchange of knowledge; the development of internationally recognised scientific research centres, particularly in developing countries; international agreements for the joint promotion, evaluation and funding of mega-projects and broad access to them; international panels for the scientific assessment of complex issues; and international arrangements for the promotion of postgraduate training. New initiatives are required for interdisciplinary collaboration. The international character of fundamental research should be strengthened by significantly increasing support for long-term research projects and for international collaborative projects,

especially those of global interest. In this respect particular attention should be given to the need for continuity of support for research. Access to these facilities for scientists from developing countries should be actively supported and open to all on the basis of scientific merit. The use of information and communication technology, particularly through networking, should be expanded as a means of promoting the free flow of knowledge. At the same time, care must be taken to ensure that the use of these technologies does not lead to a denial or restriction of the richness of the various cultures and means of expression.

37. For all countries to respond to the objectives set out in this Declaration, in parallel with international approaches, in the first place national strategies and institutional arrangements and financing systems need to be set up or revised to enhance the role of sciences in sustainable development within the new context. In particular they should include: a long-term national policy on science to be developed together with the major public and private actors; support to science education and scientific research; the development of cooperation between R&D institutions, universities and industry as part of national innovation systems; the creation and maintenance of national institutions for risk assessment and management, vulnerability reduction, safety and health; and incentives for investment, research and innovation. Parliaments and governments should be invited to provide a legal, institutional and economic basis for enhancing scientific and technological capacity in the public and private sectors and facilitate their interaction. Science decision-making and priority-setting should be made an integral part of overall development planning and the formulation of sustainable development strategies. In this context, the recent initiative by the major G-8 creditor countries to embark on the process of reducing the debt of certain developing countries will be conducive to a joint effort by the developing and developed countries towards establishing appropriate mechanisms for the funding of science in order to strengthen national and regional scientific and technological research systems.

38. Intellectual property rights need to be appropriately protected on a global basis, and access to data and information is essential for undertaking scientific work and for translating the results of scientific research into tangible benefits for society. Measures should be taken to enhance those relationships between the protection of intellectual property rights and the dissemination of scientific knowledge that are mutually supportive. There is a need to consider the scope, extent and

application of intellectual property rights in relation to the equitable production, distribution and use of knowledge. There is also a need to further develop appropriate national legal frameworks to accommodate the specific requirements of developing countries and traditional knowledge and its sources and products, to ensure their recognition and adequate protection on the basis of the informed consent of the customary or traditional owners of this knowledge.

4 Science in society and science for society

39. The practice of scientific research and the use of knowledge from that research should always aim at the welfare of humankind, including the reduction of poverty, be respectful of the dignity and rights of human beings, and of the global environment, and take fully into account our responsibility towards present and future generations. There should be a new commitment to these important principles by all parties concerned.

40. A free flow of information on all possible uses and consequences of new discoveries and newly developed technologies should be secured, so that ethical issues can be debated in an appropriate way. Each country should establish suitable measures to address the ethics of the practice of science and of the use of scientific knowledge and its applications. These should include due process procedures for dealing with dissent and dissenters in a fair and responsive manner. The World Commission on the Ethics of Scientific Knowledge and Technology of UNESCO could provide a means of interaction in this respect.

41. All scientists should commit themselves to high ethical standards, and a code of ethics based on relevant norms enshrined in international human rights instruments should be established for scientific professions. The social responsibility of scientists requires that they maintain high standards of scientific integrity and quality control, share their knowledge, communicate with the public and educate the younger generation. Political authorities should respect such action by scientists. Science curricula should include science ethics, as well as training in the history and philosophy of science and its cultural impact.

42. Equal access to science is not only a social and ethical requirement for human development, but also essential for realising the full potential of scientific communities worldwide and for orienting scientific progress towards meeting the needs of humankind. The difficulties encountered by women, constituting over half of the world's

population, in entering, pursuing and advancing in a career in the sciences and in participating in decision-making in science and technology should be addressed urgently. There is an equally urgent need to address the difficulties faced by disadvantaged groups which preclude their full and effective participation.

43. Governments and scientists of the world should address the complex problems of poor health and increasing inequalities in health between different countries and between different communities within the same country with the objective of achieving an enhanced, equitable standard of health and improved provision of quality health care for all. This should be undertaken through education, by using scientific and technological advances, by developing robust long-term partnerships between all stakeholders and by harnessing programmes to the task.

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44. We, participants in the World Conference on Science for the Twenty-first Century: A New Commitment, commit ourselves to making every effort to promote dialogue between the scientific community and society, to remove all discrimination with respect to education for and the benefits of science, to act ethically and cooperatively within our own spheres of responsibility, to strengthen scientific culture and its peaceful application throughout the world, and to promote the use of scientific knowledge for the well-being of populations and for sustainable peace and development, taking into account the social and ethical principles illustrated above.

45. We consider that the Conference document Science Agenda – Framework for Action gives practical expression to a new commitment to science, and can serve as a strategic guide for partnership within the United Nations system and between all stakeholders in the scientific endeavour in the years to come.

46. We therefore adopt this Declaration on Science and the Use of Scientific Knowledge and agree upon the Science Agenda – Framework for Action as a means of achieving the goals set forth in the Declaration, and call upon UNESCO and ICSU to submit both documents to the General Conference of UNESCO and to the General Assembly of ICSU. The United Nations General Assembly will also be seized of these documents. The purpose is to enable both UNESCO and ICSU to identify and implement follow-up action in their respective programmes, and to mobilise the support of all partners, particularly those in the United Nations system, in order to reinforce international coordination and cooperation in science.

Endnotes

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Chapter 3

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Chapter 8

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5 To be avoided: polka-dot bow ties, socks with sandals, lab coats (except in the lab), unkempt hair or beard, dirty spectacles, thick spectacles that make your eyeballs look huge, stained or ragged clothing, violent colours and colour-clashes, elbow patches, hair-nets and hygiene caps (except in hygienic conditions) T-shirts with distracting messages, and nose rings; in short, anything that tends to the eccentric and will divert attention from your message. It is acceptable wear casual clothing, bush or farm clothing for outdoor shots, medical gear, biohazard, cleanroom and radiation suits, wet suits, business suits and skirts, pullovers, sporting jumpers etc.

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Chapter 12

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