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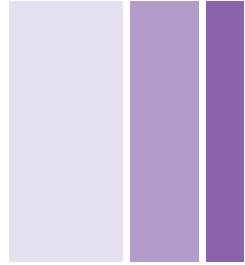
Science and the public interest



Communicating the
results of new scientific
research to the public

excellence in science

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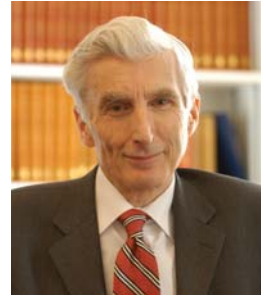
Foreword

Lord Rees of Ludlow,
President of the Royal Society

The vast majority of scientific papers are of direct interest only to specialists, even if they report research of long-term importance. However, a few journal papers are published every week that have immediate relevance – perhaps for health and safety, or for public policy.

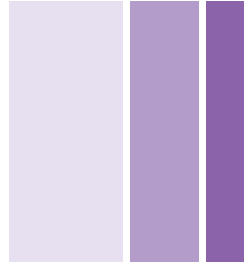
Usually, new research results are disseminated within the research community via conference presentations and journal papers; wider communication is usually an afterthought. However, the way this is done – by, for instance, press conferences or media releases – can strongly colour public reactions and attitudes, especially if there are immediate implications for people’s health or way of life. Recent episodes such as the high-profile discrediting of papers on cloning are likely to bring the quality and reliability of all research under greater scrutiny. And even when a result is firm, it is important to convey its impact fairly – neither over-hyping potential spin-offs, nor exaggerating potential risks.

The publication of this report, aimed primarily at researchers, is very timely. I commend it to every member of the research community and indeed to anyone interested in the communication of research results to the public.



Foreword

Sir Patrick Bateson,
Chair of the working group

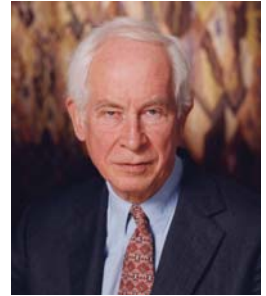


This report has resulted from three years of investigation by the Royal Society into best practice in communicating the results of new scientific research to the public, carried out as part of the Society's 'Science in Society' programme with generous support from the Kohn Foundation. The study was carried out by a working group drawn from science in academia and industry, scientific publishing and groups representing consumer and patient interests.

Throughout the study, the working group focused on identifying practical measures that would represent improvements for both the public and researchers. We hope that this document will help researchers to understand and be aware of the importance of the key public interest issues. It is they who are largely responsible for how and when their results are communicated.

The Royal Society will be disseminating the content of this report widely to the research community both within universities and within private companies, as well as among the publishers and policy-makers. Although we have focused on this issue from the perspective of the UK, we believe that it will be relevant to researchers in other countries. These are issues that every researcher needs to consider, from postgraduate to professorial level.

Ultimately, the timely and appropriate communication of research results to the public is key to maintaining public confidence, and one in which both the public and the research community hold stakes. Many of the challenges we have outlined in this report can only be tackled through a change in culture among researchers – we hope that this report provides impetus to that change.





Summary

Many of the biggest controversies in science over the past few years have arisen at least partly from problems in the process of communicating research results to the public. Although the number of problems has been relatively small compared to the overall output of research, they nevertheless can potentially affect tens if not hundreds of millions of people worldwide. Although most problems appear in fields directly relating to human health, they have occurred in a wide range of other areas as well.

In response to these controversies, the Royal Society established a small working group with a broad membership to consider whether improvements could be made in the way that researchers communicate their results to the public. This report, which has been endorsed by the Council of the Royal Society, presents the conclusions of the working group. The main thrust is that researchers need to think deliberately about whether and how to communicate their results to the public and that, in this, a prime consideration should be how the public interest is best served. The report is designed to help researchers whose imminent publications might merit broader communication.

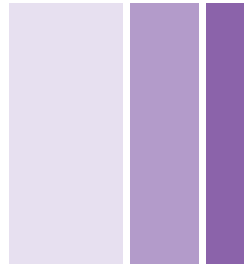
Using the UK Freedom of Information Act (2002) as a guide, the public interest is served where the communication of research results would:

- further the public's understanding of, and participation in, the debate of issues of the day;
- facilitate accountability and transparency of researchers, their funders and their employers;
- allow individuals to understand how the results of research affect their lives and, in some cases, assist individuals in making informed decisions in light of the results; and
- bring to light information affecting public well-being and safety.

Research results can have implications for the public in terms of matters such as eating habits, life-style, patient welfare, personal security and well-being, the state of human society and the state of the environment. The likely impact of research results on the public needs to be carefully assessed by the research community. The public interest is involved not only in publicly funded research but also when funds come from private or commercial sources, thereby raising issues of corporate social responsibility.

Factors such as national security, commercial confidentiality and intellectual property rights are recognised as major interests that can compete with the public interest. These can apply in cases such as research carried out by companies, or research carried out under contract from the private sector, or

Summary



research carried out by universities that wish to protect and exploit intellectual property rights. The information provided by the Department for Trade and Industry on business-university collaborations is a source of guidance on resolving potential conflicts.

In this context the research community has two main responsibilities. The first is to attempt an accurate assessment of the potential implications for the public. The second is to ensure the timely and appropriate communication to the public of results if such communication is in the public interest. These twin responsibilities should be embedded within the culture of the research community as a whole, and all practices should take them into account and respect them.

Many journals are wary, for good reasons, about revealing the identity of referees involved in peer review. Some critics argue, however, that public confidence in the integrity of the process might be improved if referees allowed their names to be revealed. A debate is needed about lifting the cloak of anonymity when an article has been accepted for publication and has public interest implications. Other changes in journal operation and practice, such as the publication of papers on the world wide web before the completion of peer review, need to be considered in terms of the implications for the public. Similarly,

great care is needed when results are communicated to the public, for instance via the media alongside a conference presentation, before they have been subjected to independent review.

Lay summaries, carefully prepared by collaboration between researchers and professional journals, could serve an important function when communicating to the public. Researchers should be encouraged to acquire the skills needed for such communication.

Calls have been made for the establishment of an independent body to watch over the release or suppression of new findings to the public. Formation of such a body, even if it took the form of self-regulation, is not likely to be popular in the research community. In the preferred absence of regulation, every effort should be made to ensure that high quality research of public interest is communicated to the public and that the importance of doing so is widely understood in the research community.

The report includes a checklist in Annex 1 of questions to help researchers plan for the effective communication of research results to the public where it is appropriate for them to do so.

Science and the public interest

1. INTRODUCTION

The communication of research results can have significant impact on members of the public, leading to changes in their views, attitudes and behaviour. These changes can have the effect of improving people's lives, by helping them, for instance, to avoid potential dangers to their health. In some cases, however, poor quality checks before publication or misreporting of research results may damage people's lives by, for instance, exposing them to higher risks to their health.

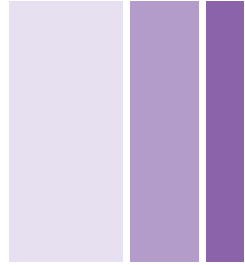
Problems in the communication of results to the public are relatively infrequent compared to the total output of research across all disciplines. Where problems do occur, it is more often, but not exclusively, in those disciplines such as medical research that have the most direct link to human health and well-being. However, enough instances of problems, across a wide range of disciplines, give cause for concern by the research community as a whole. Poor research, suppressed findings and misleading reporting of results all contribute to such concern.

It is difficult to quantify the extent of the problems that occur in relation to the communication of research results to the public, as there is no systematic monitoring of them. However, some sense of the scale can be gained in other ways. For instance, a recent survey published in the journal *Nature* [1] found that small but significant proportions of a sample of 3,247 US-based researchers funded by the National Institutes of Health admitted that they had engaged in "questionable research practices" within the previous three years that directly affected the integrity of their results. For instance, 6.0 per cent owned up to failing to present data that contradicted their own previous research and 10.8 per cent said

they had withheld details of methodology or results in papers or proposals.

Although few instances of these sorts of activities have significant direct consequences for the public, some well known cases have sparked major controversies. These have included research on the health risks of tobacco smoking, the safety of the MMR vaccine, the impact of genetically-modified foods, and the effect of human activities on global climate. These issues affect potentially tens of millions, if not hundreds of millions, of people worldwide, and although controversies may be relatively infrequent compared to the total volume of research, their impact can be very great. Not only do they have potentially negative consequences for the public, they can also damage the reputation and funding prospects of the researchers themselves, as well as reducing public confidence in science in general.

The role of the media in such controversies has been the subject of much discussion and a number of initiatives have focused on how journalists can serve the public better by improving their reporting of research results. For example, the King's Fund [2] has published a guide for the media that covers the communication of health risks that have been determined through research. The Social Issues Research Centre, Royal Institution of Great Britain and Royal Society also jointly published 'Guidelines on science and health communication' [3]. While that document included guidelines aimed at print and broadcast journalists, who largely did not welcome offers of such help, it also included a checklist for science and health professionals. It recognised that a common factor in many of the controversies has been concern about whether researchers have acted in the best interests of the public in relation to the communication of their results. The present report is



focused specifically on the extent to which the public interest is considered by the research community in science, engineering and technology in relation to the communication of research results.

To carry out this study, the Royal Society assembled a working group consisting of representatives from academic and industrial research, scientific and medical journals, the media, and patient and consumer groups. A full list of the membership of the working group is given in Annex 2. The terms of reference for the study are given in Annex 3.

Public interest can range from purely personal concerns about health and security to general matters to do with the stimulation of the economy and the invention of useful new products.

Requests for written comments on how science is communicated to the public were advertised. Also those who were known to be critical of current practices were invited to a meeting with the working group to discuss their views. A full list of those who helped in the process is provided in Annex 4. The working group was keen to ensure that its work focused on specific areas in which improvements could be made. It did not set out to consider all communication between research scientists and wider society. Much good work is being carried out at present on improving dialogue between scientists and the public. This present report is focused specifically on the way in which the results of research are first communicated to the public, and should be considered as one part of the broader process of two-way communication between scientists and

wider society. The report includes a checklist in Annex 1 of questions to help researchers plan for the effective communication of research results to the public where it is appropriate for them to do so.

Public interest can range from purely personal concerns about health and security to general matters to do with the stimulation of the economy and the invention of useful new products. Many approaches have been used [4]. The UK Freedom of Information Act (2000) provides a useful guide [5]. The Act assumes that openness is, in itself, something that is in the public interest. The Act makes clear that information 'in the public interest' is different from information that is 'interesting to the public'.

In general, the public interest is served where access to a piece of information would:

- further the public's understanding of, and participation in, the debate of issues of the day;
- facilitate accountability and transparency of researchers, their funders and their employers;
- allow individuals to understand how the results of research affect their lives and, in some cases, assist individuals in making informed decisions in light of the results; and
- bring to light information affecting public well-being and safety.

2. CONFLICTS WITH THE PUBLIC INTEREST

The Freedom of Information Act (2000) sets out as exemptions the main factors governing whether withholding information would be in the public interest, including national defence, maintaining good international relations and law enforcement [6].



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These exemptions also include trade secrets and prejudice to the commercial interests of any person. Three major science journals, Nature, Science and the Proceedings of the National Academy of Sciences, published a joint statement by journal editors on scientific publication and security [7]. The statement included the following commitment about scientific papers that are submitted to them for publication:

“We recognize that on occasion an editor may conclude that the potential harm of publication outweighs the potential societal benefits. Under such circumstances, the paper should be modified, or not be published. Scientific information is also communicated by other means: seminars, meetings, electronic posting, etc. Journals and scientific societies can play an important role in encouraging investigators to communicate results of research in ways that maximize public benefits and minimize risks of misuse.”

Research results have sometimes been suppressed to satisfy commercial interests, to the clear detriment of the public interest.

Questions are rightly asked about the integrity of the communication process when interests are present that appear to compete with the public interest. Some researchers have been bound by the terms of contracts that specify non-disclosure of research results to anybody, or disclosure only with the permission of an employer or funder [8]. As a result, research results have sometimes been suppressed to satisfy commercial interests, to the clear detriment of the public interest. This has particularly been true of some research carried out and funded by the tobacco industry into the health effects of

smoking. These cases have resulted in damage to public health and have profoundly harmed the reputations of all those involved, and perhaps even of the research community in general. Universities UK and Cancer Research UK published a ‘Joint protocol on tobacco industry funding to industries’ [9]. This includes a commitment that “funding should never be accepted for research where the researchers do not have freedom to conduct their work in accordance with normal scientific and research conventions, which includes publication of results.”



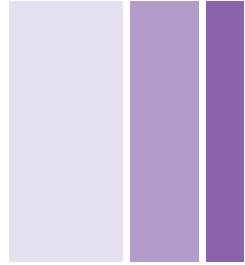
3. INTELLECTUAL PROPERTY

How do researchers in universities balance competing interests when considering whether to communicate their results?

The Royal Society has considered in a previous report how the protection of intellectual property rights can affect the way in which knowledge and ideas are exchanged between researchers [10]. It concluded:

“In short, although intellectual property rights are needed to stimulate innovation and investment, commercial forces are leading in some areas to legislation and case law that unreasonably and unnecessarily restrict freedom to access and use information and to carry out research. This restriction of the commons by patents, copyright and databases is not in the interests of society and unduly hampers scientific endeavour.”

The report of the Lambert review of business-university collaboration [11] pointed out that “... a large number of businesses and universities feel that lack of clarity over intellectual property ownership is a major barrier to business-university collaboration.” It concluded that: “Companies should have secure rights to the intellectual property they



want to commercialise, but it is also important that any deal on intellectual property should not unreasonably constrain the university from publishing the results in a timely fashion, from doing further research in the same area, or from developing other applications of the same intellectual property in different fields of use.”

Among its recommendations was the following: “The Association for University Research Industry Links (AURIL), the Confederation of British Industry (CBI) and the Small Business Service (SBS) should produce a small set of model research collaboration contracts, for voluntary use by industry and universities.” In response the Lambert Working Group on Intellectual Property was set up in May 2004, with members drawn from the CBI, AURIL, SBS and Regional Development Agencies, as well as a number of UK companies, universities and representative bodies. This group produced five model research collaboration agreements. Four of the agreements provide for the university and its staff to publish the results arising from collaborations, after an agreed period. The fifth provides for contract research or research services agreements under which the university has no rights to publish the results. The Department of Trade and Industry has set up a web site [12] giving guidance about these five types of agreement. It includes advice on the responsibilities of universities, under the terms of the Freedom of Information Act and therefore with regard to the public interest, in relation to the agreements, including those under which they have no right to publish research results.

The public interest has an obvious application to research carried out and sponsored by publicly-funded bodies, such as universities. However, the concept of the public interest should also be applied to research carried out by and for private sector organisations

even though the issues are complicated by commercial considerations. In many of the controversies over the communication of research results that have involved the private sector, a central issue has been the perception that competing interests were allowed to impact on, or even over-ride, the public interest [13].

4. CORPORATE SOCIAL RESPONSIBILITY

The UK Government has set a target for private sector investment in research and development to increase by 37 per cent between 2004 and 2014 [14]. Clearly any guidelines for desirable practice in communicating results must be applicable to companies’ in-house research activities. At present, rules and regulations governing disclosure of research results differ between the various business and industrial sectors. Some, such as the pharmaceuticals sector, include very specific responsibilities with respect to reporting the results of clinical trials.

A briefing on Corporate Social Responsibility (CSR) published by the Confederation of British Industry stated:

“Although there is no universally agreed definition of the term, CSR requires business to acknowledge that its responsibilities extend beyond maximising profitability – and thus shareholder value – to meeting the needs of other interest groups. Often referred to as ‘stakeholders’, these groups may be defined as those with which the company closely interacts – such as employees, suppliers and local communities – or more broadly to include national governments and societies as a whole.” [15]

The UK Government has a website dedicated to corporate social responsibility [16]. It states:

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“The Government sees CSR as the business contribution to our sustainable development goals. Essentially it is about how business takes account of its economic, social and environmental impacts in the way it operates – maximising the benefits and minimising the downsides.”

“Specifically, we see CSR as the voluntary actions that business can take, over and above compliance with minimum legal requirements, to address both its own competitive interests and those of wider society.”

Special difficulties can arise when exploiting new findings for commercial production when a company has a natural interest in protecting its investment. Also, special issues to do with confidentiality will usually apply in research relating to security and defence. Nevertheless, considerations of intellectual property rights, commercial confidentiality and security, whilst important, should not invariably prevent the research community within the private sector from meeting their responsibilities with respect to the communication of research results that have implications for the public.

5. DISCLOSURE REQUIREMENTS

Listed companies are faced with a particular dilemma.

In accordance with the guidance from the UK Listing Authority on the disclosure of price sensitive information, announcements about research results made by listed companies must take account of the financial interests of parties such as shareholders. However, such announcements ought to be accompanied by the disclosure of enough information to allow other researchers to make an assessment of the implications for the public. The disclosure of ‘price sensitive information’ in the form of research results is also likely to be covered in the

United States by the terms of the Sarbanes-Oxley Act of 2002, which seeks to protect investors by improving the accuracy and reliability of corporate disclosures. The disclosure of results that are subject to the laws of other countries in addition to the UK will need special consideration by researchers.

6. NEGATIVE RESULTS

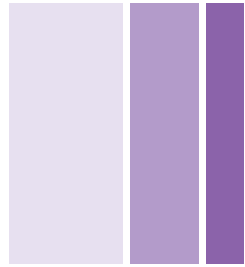
Some current ‘normal’ practices within the research community are not consistent with public interest.

One example is the tendency not to communicate results that are negative, in the sense that they do not show a difference between an experimental or treatment group, on the one hand, and a control or comparison group on the other, or that they do not show an association between two variables. Where the disclosure of negative results is in the public interest, for instance because they relate to the safety of products or services, it is important that they be published. In relation to medicines, a joint position statement by four major international pharmaceutical trade associations makes a commitment to the principle of making public the results of post-market clinical trials within 12 months of completion [17].

7. RESPONSIBILITIES OF RESEARCHERS

The research community, within both the public and private sectors, needs to shoulder two main responsibilities in relation to public interest matters.

The first is to attempt an accurate assessment of the potential implications for the public. The second is to ensure the timely and appropriate communication to the public of results if such communication is in the public interest. These twin responsibilities ought to be embedded within the culture of the research



Research results must be checked for accuracy, integrity and credibility before they are communicated.

community as a whole. Once a decision has been taken to communicate results to the public, each researcher has to consider the question: what information about my results should I communicate? Many of the controversies that have arisen in recent times about research results are directly linked to problems in relating the new findings to public concerns and aspirations. Those outside the research community feel that the provision of appropriate context is a requirement when new research results are communicated. Some aspects of context are already normally considered by the research community during the communication of results to other researchers. These include the following:

- indicators of the accuracy of the results;
- indicators of the integrity and credibility of the results e.g. management of competing interests;
- information about the ethical conduct of the research, for instance in terms of the use of animals or human subjects;
- indicators of uncertainty in the interpretation of results;
- expressions of risk that are meaningful; and
- comparison of the new results with public perceptions, 'accepted wisdom', previous results and official advice.

These aspects are equally important in public communication. In addition researchers have a responsibility to communicate to the public appropriate context for new research that relates to:

- eating or life-style habits of consumers;
- the welfare of patients;
- personal security or other issues affecting the well-being of individuals;
- the state of the environment;
- human society in general, either in the UK or abroad; and
- public policy.

It is beyond the scope of this study to examine the extensive literature on uncertainty and risk. Also the study has not considered whether action should be taken before it is certain that no harm will be done, or whether lack of full certainty is a justification for preventing an action that might be harmful. Such issues relate to applications of various versions of the precautionary principle and are much discussed [18].

8. QUALITY CONTROL AND REVIEWS

Research results must be checked for accuracy, integrity and credibility before they are communicated [19]. This is certainly the main issue of concern for researchers when considering the communication of their results. It is also highly relevant to the issue of public interest. Quality control mechanisms should filter out erroneous information about research results. These mechanisms must not be so slow that they prevent the timely release of accurate information; and they must not be subject to undue influence by competing interests, commercial or otherwise.

The peer review process, although having its shortcomings, is acknowledged almost universally in the international research community as the best way both for assessing the quality of a report of research results, and indeed for improving it. As such, it



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provides the best way of demonstrating to the public, as well as to scientific colleagues, the accuracy, integrity and credibility of new research results.

Peer review has, however, been subject to criticism from outside the research community for delaying or even preventing the disclosure of research results that may have a bearing on the public interest. Of course, delays and misuses of peer review would also be criticisms of the peer review process from the view of the research community as well. In general, the public interest is best served by a quality control mechanism that is of optimal use to the research community.

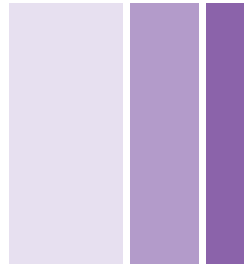
Some writers have suggested the transparency of the independent peer review process for journal papers could be improved by ending the practice of keeping the identities of referees confidential. Godlee [20] argued that:

- named review is “ethically superior” to anonymous review because it increases the accountability of the reviewer, and gives less scope for biased or unjustified judgements or plagiarism under the cloak of anonymity;
- requiring reviewers to sign their reports has been shown by studies not to adversely affect the usefulness of their comments, and in one study has been shown to improve the quality;
- removing anonymity is feasible in practice, and when it does happen, authors like it because they can identify conflicts of interest that reviewers have failed to declare and reviews tend to be more constructive; and
- if reviewers are not anonymous, they can receive credit for the work that they do, creating an incentive to undertake such duties.

To be set against this line of argument, the primary purpose of anonymity is to ensure that researchers are able to give honest reviews of the work of their colleagues without fear of reprisals or the breakdown of professional relationships. Many journal editors believe that finding referees would become impossible if they were to insist on disclosure of the referees’ identities. They also argue that anonymity of referees should give greater grounds for public trust in the outcome. However, editors can at least ask referees to sign their reports on a voluntary basis and many already do so. Moves in this direction, particularly in relation to research that has public interest implications and is deemed acceptable for publication, might also help the public to understand that the processes of review are fair and transparent. Further debate within the research community about the benefits and disadvantages of referee anonymity is desirable.

It is important that papers make clear the statistical limitations of research results.

It is no coincidence that some of the biggest public controversies of recent years that have surrounded research results have arisen from the statistical significance of, for instance, epidemiological data, or the use of meta-analyses. Many journals ask their referees whether further expert advice should be sought in the statistical analysis of reported data. Of course, statisticians do not always agree with each other. Occasionally they insist on inappropriate methodologies for a particular area of research, or pick on details that do not affect the overall outcome of the analysis. Nevertheless, it is important that papers make clear the statistical limitations of research results, for instance if they are extrapolated from small samples to reach conclusions about a



larger population. Making clear the limitations of extrapolations to human populations is also essential, for instance when the results are derived from research using non-human species, or mathematical models, rather than being directly drawn from the populations to which the conclusions are generalised.

9. NEW FORMS OF COMMUNICATION

The process of the communication of new results between researchers is subject to continuous innovation in order to serve the research community more satisfactorily.

A number of online repositories and archives are already in operation on the world wide web, allowing reports of research results to be posted before they have been subjected to the full independent peer review process [21]. While this practice has clearly developed for the benefit of the researchers, little consideration appears to have been given to the consequences of this practice for the public. It is true that research results, later shown after peer review to be erroneous, have rarely been communicated to the public after appearing on a pre-print server. Nevertheless, the potential for great damage clearly exists. The same point applies to the process of so-called 'open review' [22]. At the very least researchers and editors should consider their responsibilities before making the material openly available before peer review.

10. CONFERENCES

Scientific conferences raise special concerns. Presentations made at conferences may include preliminary results and other findings that may not have been subjected beforehand to independent peer review.

However, the organisers of a conference may promote research results as a form of advertising for their event.

Whilst such practice is not inherently wrong, it does raise the question of whether the public interest is best served if the results that are being communicated are later shown to be wrong after they are subjected to a quality check. One estimate is that about half of the presentations of new research results at conferences never appear in peer-reviewed journal papers [23]. The participants and organisers of scientific conferences should recognise their responsibilities by making clear the extent to which the contents of presentations have been subjected to a quality check. Indeed, the research community has even greater responsibility for considering the public interest when the research results in conference presentations have not been subjected to rigorous quality checks.

11. LAY SUMMARIES AND MEDIA RELEASES

While researchers should recognise their responsibilities in considering the wider context of their results, they may not necessarily be best placed to consider, for instance, the implications for public policy.

Researchers should seek advice, when needed, about what the appropriate context for their results is and should be alert to how their results may be used by other individuals and organisations, such as campaigners or policy-makers. If research results are considered to have implications for the public, researchers would be well advised to notify relevant regulatory bodies (e.g. Food Standards Agency, Medicines and Healthcare Products Regulatory Agency) before communication of the results to the public. Most regulatory bodies have well-established mechanisms for assessing the implications of research

results, and the research community should be aware of these bodies, and be prepared to interact with them. For their part, funders, sponsors and employers of researchers should be ready to offer advice about how to assess the implications for the public and provide guidance about whether the disclosure of results would be in the public interest.

Misleading media reports have occurred because of inaccurate press releases about the results of new research.

The results of research can be communicated to the public in a number of ways. They may be presented in public fora, such as lectures, workshops and meetings. They can appear in a 'lay' style, either in a publication or on the web. However, the main way in which research results are communicated to a wide public audience at present is through the national and local print, broadcast and online media. Usually this is achieved through a media release prepared to coincide with the publication of a peer-reviewed journal paper. Some journals also produce lay summaries that may be prepared in consultation with the authors. For instance the journal *Annals of Internal Medicine* publishes a 'Summary for Patients' on its website [24] for any paper which the editor believes has implications that need to be presented in a 'lay' form. The Summary is written by the editor who oversaw the review of the paper. It is sent to the authors for comment and is informally reviewed by staff at the journal.

Lay summaries need to be subjected to the same level of review as technical papers before publication. As journal papers generally do not provide appropriate context for the public, the review process for lay

summaries may be different to that of technical papers. It may also mean that a journal editor consults a reviewer who has specific expertise in identifying implications for the public.

Misleading media reports have occurred because of inaccurate press releases about the results of new research [25]. In these cases, it appears that the researchers whose results have been described have not always been consulted about the content and style of the press release. Sometimes too researchers produce inept summaries of their work in an attempt to gain publicity for their work. Guidelines for communicating with the media were issued by the Social Issues Research Centre, the Royal Institution and the Royal Society [3].

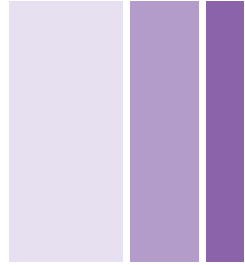


12. CONCLUSIONS

This report is intended to raise the awareness of the research community in relation to research results that have implications for the public.

Good communication is crucial. Of course, not all researchers will choose to become skilled communicators, but those who wish to do so should be encouraged and given assistance in developing their competence. Certainly they should not be penalised by their funders, sponsors or employers. Learning to communicate with the public should be viewed as a core element of continuing professional development. The Royal Society has carried out a survey of the factors affecting communication activities by researchers to provide evidence to funding organisations, universities and other research institutions on which they can base a workable system to reward scientists for their efforts to engage with the public.

Science and the public interest



The mood has been changing, particularly in relation to medical research. The Medical Research Council [26] and the Wellcome Trust [27] have introduced codes of practice, including guidelines for the communication of research results. The UK Panel for Research Integrity in Health and Biomedical Sciences and the UK Research Integrity Office were launched in April 2006, with the aim of eliminating malpractice in research within universities, the National Health Service and industry. The Panel and Office will develop a code of good practice and provide advice, rather than carrying out regulatory roles [28].

Such a body was proposed by the Committee on Publication Ethics and has equivalents already established in other countries. The United States has the Office for Research Integrity (ORI), charged with overseeing the conduct of publicly-funded biomedical and behavioural research. The ORI, among other things, promotes good practice, issues guidelines, monitors compliance and investigates cases of misconduct. The argument in favour of establishing such a body in the UK is that the prevalence of misconduct or poor conduct is no more likely to be higher in those countries that have decided to introduce bodies to monitor research conduct than in the UK. On these grounds the public might well expect some regulation of the scientific community and, if the pressure were strong enough, the control might become statutory.

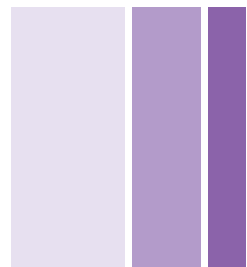
Would the public interest be served best by the formation of an over-arching and independent body to monitor and give advice on desirable practice in communicating research results? A proposal to establish an independent body to deal specifically with problems relating to the communication of research results might well be a disproportionate solution to a relatively small problem. It might also be unduly bureaucratic.

Most scientists feel that they have to contend with too much assessment and bureaucracy as things are. Almost certainly the proposal to establish a new body, even one that was self-regulatory, would be deeply unpopular in the scientific community. Even though the establishment of a body concerned with the communication of research might forestall public demands for statutory control, the sceptical response would be that such a body would merely add another burden to scientists without satisfying those members of the public who seek a greater degree of control over science. Be that as it may, desirable modes of conduct among the scientific community depend on a reaffirmation of the old virtues of honesty, scepticism and integrity. The major thrust of this report is that, in addition, the research community should consider the public interest when communicating research results to the public. If the report stimulates developments in that direction, it will have achieved its primary aim.



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ANNEX 1

Checklist for researchers

These questions may help researchers to take the public interest into account when considering the communication of their results to the public.

1. What implications, if any, do your research results have for the public, for instance in terms of:
 - the eating or life-style habits of consumers;
 - the well-being of patients;
 - personal security or other issues affecting the well-being of individuals;
 - the state of human society in general;
 - the state of the environment; or
 - public policy?
2. Would the communication of your results be in the public interest, in terms of:
 - furthering the understanding of, and participation in, the debate of issues of the day;
 - facilitating accountability and transparency of researchers, their funders and their employers;
 - allowing individuals to understand how the results of research affect their lives and, in some cases, assist individuals in making informed decisions in light of the results; or
 - bringing to light information affecting public well-being and safety?
3. Do you need any advice to help you to decide whether communication of your research results would be in the public interest, and if so whom do you need to assist you?
4. Are there any reasons why disclosure of your research results might not be in the public interest, such as national security considerations?
5. Are there any other interests, such as commercial confidentiality, stock market regulations or intellectual property rights, competing with the public interest in terms of the communication of your results?
6. Are you able to provide the appropriate context for your research results, such as:
 - indicators of the accuracy of the results (eg statistical significance);
 - indicators of the integrity and credibility of the results;
 - information about the ethical conduct of the research;
 - indicators of uncertainty in the interpretation of results;
 - expressions of risk that are meaningful; and
 - comparison of the new results with public perceptions, 'accepted wisdom', previous results and official advice?
7. Do you need any advice to help you to provide appropriate context for your results, and if so whom do you need to assist you?
8. How might your results be used by other individuals or organisations, such as campaigners or policy-makers?
9. To what extent have your results and their context been subjected to a review of their accuracy, integrity and credibility, for instance through a peer-reviewed journal?
10. In terms of the public interest, when would it be best to communicate your results to the public?
11. In terms of the public interest, what would be the best way for you to communicate your results to the public?
12. If you are presenting results at a scientific conference, is it in the public interest for them to be communicated to the public at this stage?
13. Is there a regulatory body which you should contact about your results?
14. Do you need to provide a 'lay summary' of your results and their implications for the public?
15. Have you checked any materials prepared for the media about your results?

ANNEX 2

Members of the Royal Society working group on communicating the results of new scientific research to the public

Sir Patrick Bateson FRS (Chair): Emeritus Professor of Ethology, University of Cambridge, and former Vice-President and Biological Secretary, Royal Society

Dr Philip Campbell: Editor of Nature

Dr Linda Cummings: Royal Society Dorothy Hodgkin Fellow, Department of Mathematics, University of Nottingham

Sir John Enderby CBE FRS: Professor of Physics, University of Bristol and former Vice-President and Physical Secretary, Royal Society

Professor Paul Harvey FRS: Head, Department of Zoology, University of Oxford

Professor Justin Lewis: School of Journalism, Cardiff University

Dr Alan McNaught: Science Policy and formerly Journals General Manager, Royal Society of Chemistry

Dr Mike Owen: Senior Vice-President and Head, Biopharmaceuticals Centre of Excellence for Drug Discovery, GlaxoSmithKline

Mr Nick Partridge OBE: Chair, Consumers in NHS Research

Dr Andrew Sugden: Senior Editor, Science

Mr John von Radowitz: Science Correspondent, Press Association

Ms Alex Williamson: Publishing Director, BMJ Specialist Journals

Secretariat

Dr Darren Bhattachary

Ms Rebecca Humphreys

Mr Phil Hurst

Mr Bob Ward

Dame Sheila McKechnie, Chief Executive of the Consumer's Association, attended the first meeting for the study. The working group records its sadness at her death in 2004.

Mr Andrew Greene, formerly of Merlin Sciences, also contributed to the working group during earlier stages of the study.

ANNEX 3

Terms of reference

The terms of reference for the study were:

- to consult major stakeholder groups, including academic and industrial scientific researchers, journal publishers, journalists and the wider public, about how scientists should make public the results of their research;
- to identify ways in which the peer review process could be improved to increase confidence in research results released to the public, and to identify alternative mechanisms for assessing the quality of scientific research before it is released to the public;
- to produce a document for dissemination to Fellows, all researchers who receive support from the Royal Society, and the wider scientific community (within and outside academia), offering guidance on best practice in releasing the results of scientific research into the public domain.



ANNEX 4

List of individuals and organisations that submitted written evidence

Scott Armstrong, University of Pennsylvania

Ms Gundula Azeez, Policy Manager, Soil Association, Bristol

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John Barwise, Sustainable Projects

Grace Baynes, Marketing Communication Manager, BioMed Central, London

Professor Peter Belton, President, Institute of Food Science & Technology, London

Allan Berry, *Chairman*, Society for the Protection of Salmon & Sea Trout, Perthshire

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Petra Boynton, Lecturer, Primary Care & Population Sciences, University College London

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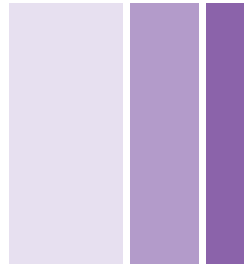
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Ian Flintoff

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Peter Goddard, President, London Mathematical Society



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James Greenhalgh

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K Hellmann

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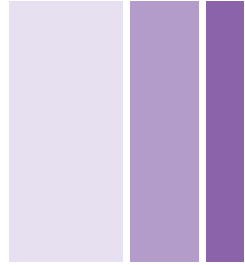
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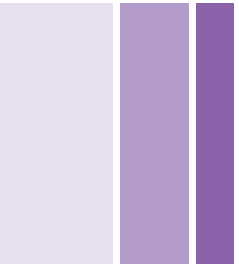
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