

# Media Coverage of Genetic Issues

## *A Model of Current Coverage*

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## **1.0 Abstract**

In this paper I hope to provide description and analysis of the coverage of genetic issues in segments of the media. To achieve this I have drawn on an extensive literature review - both specific to the media and generally the critic of science, a media survey of two leading broadsheets and several interviews with leading professionals in the areas of journalism and science. The findings of this survey indicate that there are two distinct models of coverage in the two newspapers assayed. The models elucidated point to differing styles of coverage in terms of content and tone and the interviews go some way to explaining the differences seen between the two models. Hopefully the descriptions given here will be instructive for scientists in their interaction with the press and possibly to the press in their creation of coverage.

## **2.0 Introduction**

It has become commonplace for scientists, journalists, non governmental organisations (NGOs) and increasingly the public to refer to the 'Genetic revolution' and the huge importance of genetics, cloning and biotechnology today. In a deepening and widening argument staged much like a play, Frankenstein's monster and "the spectre of eugenics"<sup>(1)</sup> are brought out as allegories on one side, miracle cures and "'designer' babies"<sup>(2)</sup> float from excited portrayals on the other. It seems as though style has come to outweigh substance. Credibility or the relative lack of it, bright lights, loud words and other theatrical tricks have come to characterise this play of genetics rather than serious analysis. Despite this, despite the repetition and hyperbole, the importance of genetics as an area of science *is* paramount. Our lives and society are already being touched; soon they may be moulded and shaped as genetic therapies, screening and databases move from the realms of science fiction to fact. Our world is already distinct from its natural state, as are our farms, agricultural practices and livestock. <sup>(3)</sup> Our hospitals are different both in practice and ideology as a result, preventative therapies based on advance genetic knowledge and those tailored to an individual's genome are replacing generalised prescriptions and curative therapies. Mike Dexter, director of the Wellcome Trust describes the results of these changes as, "An era where science will pervade most aspects of life." <sup>(4)</sup> Faith and trust in both the institutions and the individuals that constitute science and journalism are diminishing

though. It is not just politicians who earn the public's scorn on a routine basis. The beneficence, security and innocence of science in particular seem dubious and in need of constant qualification. <sup>(5)</sup> "For whose benefit?" is the question of the moment. For these issues to be dealt with we need a better model for coverage of important genetic events, professional disgruntlement points to this, public interest demands and justifies this. As Mike Dexter and Robert May have noted in a joint public statement, "The magnitude of the changes that we may experience in our daily lives as a result [of advances in genetics] make it imperative that scientists, policy-makers and the public listen to each other. Recent experiences with genetically modified (GM) crops and Bovine spongiform encephalopathy (BSE) have shown the unhappy consequences of a breakdown in this communication."<sup>(6)</sup> The public's distrust of science was reiterated at the Royal Societies' National Forum for Science: The People's Science Summit. Fears over credibility and trust were the most prominent raised at both the national level forum and the regional level debates, both of which I attended as background for this project. <sup>(7)</sup>

## **2.1 Project outline**

The purposes of this survey are manifold; the key task though is to provide a working model of the current presentation of genetic issues in the mass media. Secondary to this will be the proposal of alterations to any identified models in order to optimise their representations. By genetic issues I mean to include all of that which has been subsumed into this field. This includes both medical and agricultural theory and the practical application of such techniques in what is increasingly lumped under the term biotechnology. The very diversity of such fields creates a problem in itself when trying to generalise on how such issues are or should be communicated. There are key concerns here that apply to science generally but also specific themes that mark out genetics and biotechnology as requiring immediate attention. The novelty of these fields gives them both a fervent importance in the first place as well as a peculiar uncertainty resulting from the lack of precedent. The nature of these fields also makes obvious in a unique manner the way in which we can and do manipulate the world. Perhaps it is because of the questions about our own nature and that of the world that are being raised, that public interest has been so high. <sup>(8)</sup>

I think it is likely that there will be at least two versions of model present, one created by journalists, of scientists and their work and one created by scientists representing journalists' portrayals of scientists. That these two versions of representation will not be convergent provides another level of complexity. It becomes most apparent in the assumption by many scientists that journalists and the media are generally opposed to genetically modified organisms and genetic techniques. In contrast a closer inspection by Horning <sup>(9)</sup> revealed the tendency of the media to favour established / institutional stakeholders rather than objectors. This school of research goes on to state that either perspective gets a better representation than the public's interest does. One of Horning's operative conclusions was that the selective portrayal of only some aspects of the issues heightens public distrust.

In amongst the concerns about safety, risk assessment, regulation, values, motivations and application is the serious concern of the public's mistrust of both scientists and the media. The string of agricultural disasters in this decade and the last has left farmers distrustful and often paranoid about scientists, journalists, the proponents of new technologies and the government. Consumer faith is little more enthusiastic. As proponents and opponents of GM become increasingly polarised, much of the finer detail falls from sight. David King, Chief Scientific Advisor to H. M. Government surmised the situation in an interview with the Guardian, "The contribution of this country to science is recognised around the world. But there is a problem with public confidence. We have to engage the public in a debate. We have to acknowledge that the lay person has a major part to play in the decision."<sup>(10)</sup> Therefore what we need is a means of getting away from the hype and back to the issue at hand; making the most considered decisions possible about the way in which we plan to proceed or not, with genetic research programmes. If the general public is to be included in this in a genuine way and to feel it has been included then a diverse range of unbiased information and some clearly labelled opinion is needed.

## **2.2 Application**

Increasingly a practical use for surveys such as this and their subject matter is being realised by scientists. An awareness of public relations can be seen in both commercial funding and media 'savvy' scientists. Professor Severino Antinori whatever he might be is certainly a master of the media circus. That this awareness is

still at a pupal level is obvious from the blunders that have ensued when it has been acted upon. This phenomenon could play out in one of two ways; there could be an escalation of the conflict between science, public relations and journalism with increasingly cynical manipulation of information being matched by an increasingly embittered cynicism towards science and public relations. An indication of the way in which this path might lead can be seen in New Labour's relationship to the press. Alternatively equipped with an understanding of the way in which journalism works, scientists may become more empowered to represent themselves and their work in a manner which they feel to be less distorted. At least they may enter the arena with an understanding of the way in which they may be misrepresented. There are after all two factors in effect here, scientists' self-portrayal and journalists' representations.

At the same time there must be some consideration of the downstream effects such posturing has in the information chain. It is important not to lose sight of one of the media's major functions, relay of information to the public. Certainly this should show some attempt at informed provision of information. That scientists might regulate themselves through the opinions of mass media, as politicians, the police and businesses sometimes do seems to be a distant prospect. The current social climate of self-service and confusion between profit, personal and societal motives makes this seem more distant.

### **2.3 Current problem areas**

The problems within science communication are numerous to say the least. Communication between journalists and scientists is often fraught. <sup>(11)</sup> Communication between press and public is equally problematic. The direction of information flow is distinctly one way:

Scientists  $\Rightarrow$  journalists  $\Rightarrow$   $\Leftarrow$  public.

This diagram quantifies consumer choice by means of the smaller arrow. Recent advertising theory has shown this effect is far less influential than some economists assert. <sup>(12)</sup> Without broaching the spurious nature of fast food, cosmetics or toiletries I think it can at least be inferred that consumer choice sometimes has rather less effect that producer persuasion and advertising can do. This is especially relevant to the media where the only real measure of consumer choice is purchase.

In other cases the miscommunication seen here is due not only to institutional restrictions on the flow information but also simple mistrust. Although broadsheet readers are more likely to draw their views from their reading than tabloid readerships a pinch of salt is still the common prescription although how often this prescription is followed is unclear. Similarly the mutual distrust between scientists and journalists could be based around suspicion of professional roles. Journalists are simple hacks and scientists are quacks or commercial stooges. Recent history has reinforced such misconceptions and suspicions. Swine fever, BSE, foot and mouth and genetically modified organism field tests have all increased the public and the media's mistrust of scientists. Scientists' disenfranchisement from journalism was increased as they felt themselves to have been misrepresented by coverage.

Equally serious problems arise when the objections or reservations to genetic technologies and techniques are phrased exclusively in scientific terms and premises. The idea that science should remain the preserve of experts trained in this field does have some considerable weight, certainly in practical terms. This however leaves a feeling of complacency amongst scientists and the press, who having assessed the safety aspects or acceptability of risks involved seem to consider the subject closed to other forms of examination. The danger of this is that it leaves all consideration of economic, social and ideological impacts un-broached. In short this kind of agenda setting does a disservice to both the opponents and the proponents but ultimately and most importantly the consumer. <sup>(13)</sup> A broader analysis by both groups is needed if the public's trust is to be gained.

## **2.4 Conceptual framework**

Other comment on the system of information flow comes from several areas. Philosophy, history, ethics, gender and cultural studies all have input in this field. So they should it seems, the workings of scientific phenomena may still be contentiously independent but the observers and interpreters are invariably human. Therefore the humanities feel they must have something to add.

In the field of cultural studies Stuart Hall <sup>(14)</sup> has done much to dissect the manner in which media messages are constructed and subsequently decoded or interpreted. Hall assigns the motivators in both processes as 1) frameworks of knowledge, derived from education and experience. 2) Relations of production - in the

Marxist sense and 3) technical infrastructure. Frameworks of knowledge seem particularly compelling in science journalism, however relations of production and technical infrastructure should not be underestimated in their influence on the 'creation' of news. Within them is encompassed both the commercial and institutional restrictions seen in the media. The theory I have used here, as guidance and description of the way in which journalists write stories or in Hall's terms 'encode' them. This gives us a powerful tool for thinking not only about the institutions and the collective processes of communication but also considering the individual and in turn the societal influences which shape the individual's actions.

My understanding of the positioning of science and its analysis is drawn from the chronicles of critique laid out by Rose,<sup>(15)</sup> Ravetz<sup>(16)</sup> and Ross.<sup>(17)</sup> Rose and Ravetz concentrate mainly on the radical critiques of the sixties and the subsequent work of Kuhn, Popper, Feyerabend and numerous others in expounded on the ideas of this period. Both pay attention to the dissolution of the myths of *security, discovery, reality, innocence, openness* and *beneficence* surrounding science. Rose continues in her work to elaborate a feminist epistemology for science whereas Ravetz explores 'alternative' movements. Both however give a good grounding in critique. Ross uses the development of cultural studies as his framework for chronology, concentrating largely on the Sociology of Scientific Knowledge or SSK program and resultant 'science wars'. His call for a critique of science within a social context is an extension of the SSK. Ross criticises the value neutrality of that program and its refusal to allow social influences any part but holds with the findings as to how lab life proceeds. In response to the argument that "contamination" of science through contextualisation and societal influences somehow diminishes its truth, Ross argues that such a positioning of science actually strengthens its applicability in society. In many ways this pre-empts Harding's<sup>(18)</sup> call for a standpoint-based approach to science. He also draws on Haraway's conception of 'situated knowledge'<sup>(19)</sup>, or knowledge that is not diminished in its objectivity, nor devalues existing knowledge. In a nutshell Ross's work implies that for any critique of science to be effective it must take some account of societal influences. Criticism is essential for Ross because, "the cloistered scientist, shielded from self critical knowledge about the social origins and conditions of his or her instruments, has emerged as a much greater danger to our social and environmental survival than the cloistered humanist."<sup>(20)</sup> Note that the pretence of objectivity fostered by those who champion 'pure' and universal science is a far more

problematic stance to take, than an *aspiration* to objectivity would entail. A realization of the humanity of scientists is often overlooked here.

Although Ross calls for a Cultural Studies based critique of science, for such a critique to be a widely accessible analysis, I feel that the mass media should be the vehicle. If this is to be possible though, a considerable clearing of house in the media world is necessary. It seems incredible that a profession so fiercely defensive of its autonomy should allow itself to become little more than a mouthpiece in this field. The reliance of the media on press releases and the effects of recycling these releases continually do little to promote the image of coverage as independent and critical. Possibly laziness, financial and time constraints coupled with a lack of understanding are responsible, as Nelkin argues in her book, "*Selling Science*." <sup>(21)</sup> This seems to underestimate the intelligence of journalists, although Nelkin makes her argument coherently and this remains the key text in science communication today.

I have also drawn on David Berube's as yet unpublished manuscript, "*Rhetoric*." <sup>(22)</sup> In this piece Berube describes the process by which scientific jargon and rhetoric have excluded what he terms 'citizen-consumers' from the policy making process. This is as plausible as Nelkin's interpretation, as a cause of bad communication. I have therefore tried to reflect the effects of rhetoric in the media, in this project's survey.

My theoretical understanding of the effects of science in the media and the structures of control that currently exist is drawn from papers by Forgacs <sup>(23)</sup> and Appadurai. <sup>(24)</sup> Appadurai's work used here comes from, "*Global Culture: Nationalism, Globalization and Modernity*." This essay stems from a pro – globalisation, postmodernist stance. It represents a move away from analysis based on oppositional forces, or centre/periphery distinctions. The organic form of his representation allows for a far more complex model of the social economy and subsequent analysis than contemporary neo-Marxist representations. Appadurai is careful to warn of both the advantages and disadvantages of the move towards an integrated, globalised society. He paints a world characterised by the competition between sameness and difference found in the disjuncture, interaction and contextualisation of global 'flows' or '*scapes*'. These *scapes* represent the contours of landscapes crafted by societal forces that Appadurai lists as media, technology, finance, ideology and transient populations. This system also helps to describe the vast differences of distribution of both the metaphysical and the physical. As Appadurai concludes; "the critical point is that both



sides of the coin of global cultural process today are products of the infinitely varied mutual contest of sameness and difference on a stage characterized by radical disjunctures between different sorts of global flows and the uncertain landscapes created in and through these disjunctures.’<sup>(25)</sup> The idea of using Appadurai’s style of analysis while trying to critique science becomes very appealing, when the diverse influences upon science and its communication are considered. The values made inherent in us and science by our education and religion often become shrouded. The fact that most science is now privately funded and that media exposure is directly related to funding “draw” and financial viability is obvious in numerous examples. Compare funding budgets and media coverage of BRAC-1, a gene associated with familial breast cancer, with those for onchocerciasis, a disease prevalent in Latin America and Africa causing blindness and death. The media too faces pressure to capture reader’s interest, often though this is at the expense of serious analysis. In recent years there has also been a growing trend towards an annexing of the press, as an information distribution system for various government and private scientific concerns. As Upton Sinclair complained in 1919, journalism has become, “A business in the practice of presenting the news of the day in the interest of economic privilege.” To Nelkin this may largely be due to a growing perception of the media as, “A major vehicle to enhance the public support of science.”<sup>(26)</sup> Another way to look at Appadurai’s work means that if we concede that both scientists and journalists share much in common, often with a similar education and operating under the constraints of economics and politics, we come much closer to seeing the actual relationship between both professions. In this interpretation it becomes apparent that many of the problems associated with science and its place in society, as defined for the public by the press, lie not just in the disjuncture between these “*scapes*” but in the interfaces and relationships held between them.

By understanding the relations between these imagined worlds of media and science and their relation to the other imagined worlds constituting society we may be able to effectively shape our world as we should. In much the same way that in-vitro studies and single gene analysis are soon to be abandoned – genomics superseding genetics, it is not enough to dissect science or media alone or even together. Real understanding of these issues in science and the media can only be gleaned by understanding the dynamics of all these imagined worlds and their interplay together.

This begs the question, what is the media's role in relation to science? Is it simply to relay information, to provide analysis or more sinisterly to generate acceptance? In defining what this relationship should ideally be, we need also to consider the forces which shape this relationship both by their influence on these fields, separately and in their interaction. Certainly if we are to use the media for the sort of critique and informative role I will suggest here, this must be one of our first considerations.

The second part of my framework for analysis comes from Forgas's reinterpretation of Gramsci. Forgas relates the ineffectual resistance to the fascists in Italy, from which Gramsci envisioned the need for a 'national popular', to the disparate and ill aligned Labour party in 1980's England. "At a time when the tough and flexible ideological resources of Thatcherism proved capable of mobilizing a popular base, the dangers of this kind of impasse became clear. Moreover the late 1970's and early 1980's in Britain have seen a renewed spate of militancy among groups and social elements or uniform class coalition. It is these two things arrayed against one another - the new state formation and the heterogeneous oppositional forces - which produce the need for a national popular."<sup>(27)</sup> I think that there are two central elements that maybe derived here, firstly that the presses' unwillingness to critique science maybe the result of the peculiar altern alliances formed between it's self and other spheres previously identified. Secondly, the alliances involved need to be analysed. Science relies heavily on the media to publicize and draw funding to its progress, while at the same time helping to shape public attitudes. Less conspicuously the media relies upon science, obviously to makes itself accessible, understandable but more covertly through shared societal and financial interests. Control over scientific knowledge is integrally linked to power over public affairs. Additionally a report published at the end of the 1970's found that most science stories covered are related to the external interests of the newspapers managerial staff.<sup>(28)</sup> In addition to this alliance, finance and science seem now to be more and more convergent.

## **2.5 Previous studies**

Previous studies in this area can be segmented into two groups - those that have assayed media coverage and those that have assayed public opinion. I have used David Craig's study, "*Ethical language and themes in News Coverage of Genetic*

*Testing*"<sup>(29)</sup> as an example of present work in this area. In this study Craig looked firstly at the ethical issues raised by mass media – with special reference to consequentialist and deontological themes, or consequences and beneficence. He then assayed whether ethical language was explicitly used. Also assessed for both presence and depth are four themes that Craig identified as; whether you would want to know your medical future? What would you do with the information? The complexity of choices faced and the possibility of discrimination based on genetic information. The identification of themes and their presence in news stories is a technique which I have employed in my own survey.

The other media survey I have used in places, as a model for my own is Corbett and Mori's, *"Medicine media and celebrities: news coverage of breast cancer, 1960-1995."*<sup>(30)</sup> Over a thirty-six year period the research investigates the relationships between medical activities, public events and media coverage. Findings included a two-way concurrent link between funding and coverage and a significant link between public events and coverage. It is the quantitative (though tentative) style of survey found in these surveys that I would like to emulate in my own.

There have also been two governmental reports in this area that I would like to draw on. These focus more on the public perception end of the process, in themselves they also provide a fine justification for the concentration of debate in this area, highlighting the importance of science and technology more generally to the public. The first is the NSF's, "Science and Engineering Indicators 1998"<sup>(31)</sup> and in particular chapter seven, "Science and Technology: Public Attitudes and Public Understanding." The importance of articulate communication is highlighted when the authors claim, "Approximately 27 million Americans...are attentive to science and technology policy issues" and that "Americans receive most of their information about public policy issues from television news programs and newspapers". The second is the Office on the Public Understanding of Science and Wellcome trust's, "Science and the Public: A Review of Science Communication and Public Attitudes to Science in Britain".<sup>(32)</sup> This report concludes (in summary) with obvious relevance to my project; "At the national level, there is no framework within which people can access information about new science, allowing them to assess and judge information and its implications. The respondents were unsure of how this might happen and it remains a challenge to science communicators and others. Perhaps a start might be made by organisations with different perspectives creating a public dialogue through co-

ordination of activities. So, while some organisations may not be able to join forces, because they have different objectives, dialogue between the organisations and sectors might begin to provide a framework for a national debate."

## **2.6 Applications II**

The advantages that such an awareness of and debate around genetics would confer on scientists are almost as numerous as the problems of this area. Such a critique of science could act as a kind of mental hygiene, the perils of scientists turned sociologists are equally as disturbing as the closeted mad scientist or the rogue scientist. With a greater perception of the positioning of science all three of these grotesques might be avoided. Regulation even of a self-imposed kind would generate an ethos of accountability and possibly even trust. A more specific examination of the credentials or history of the people behind scientific events often reveals as much about the validity of the work undertaken as the person undertaking it. Surely this should be one of the first steps in relaying a specific event, identification of the proponents. To continue and scrutinise the story in a social context as I argue here can only be done after some validation of the work and workers has occurred. Although this is a good first step it is the research that is most relevant and rightly the focus of analysis, checking credentials does provide a handy rough gauge though.

The main advantage that I am arguing for here is reflexivity, both in more relevant research and a better understanding of that research and its impact of society. Without meaning to push a hidden socialist agenda it seems that science which proceeds along altruistic lines would benefit from not only public endorsement but also recognition of societal rather than financial motivations. According to Harding, studies based positively around democracy enhancing standards have been shown to work and not only function but do so accurately.

### **3.0 Methodologies**

The parameters and prejudices of my work will be drawn out to maximise objectivity and hopefully through transparency provide integrity and accuracy. I am unapologetic about my personal stand-point; I approach this survey as a genetics student wishing to understand how my field of study is represented. My own views will no doubt permeate my examination, assessment and interpretation but surely my views (whether correct or not) are just as valid as anyone else's - even, as a result of my involvement in the area I wish to survey, more valid.

I want to focus this study around a particular news media in much the same way as I have chosen to focus on one area of science. In trying to get at models or modes of coverage, medium becomes another contributing factor to the form of the model. Ideally this would be a survey of all coverage, however to do any justice to the depth of interpretation I think that my field of study needs to be artificially narrowed. To be frank, scientists (and much of the rest of society excluding some dubious celebrities) have resigned themselves to indifference to the way in which tabloid coverage represents them. What a chance goes by as negative editorial as much as any thing else practices restrict trust. The huge audiences of tabloids make them hard to ignore but their relevance is diminished when readerships own perceptions of the titles are considered. It also seems, regrettably - but fortunately for me - that the problems of tabloid coverage are not restricted to science and media interactions but largely due to problems of tabloid coverage per se. This is not to say that broad sheet coverage does not pose problems in itself as a medium - political alignments and other effects are no doubt provide hindrance, the difference here though is that maybe we should expect something more than entertainment when we read a broad sheet.

My choice of titles is also restricted by availability of archive access. None of the tabloids provides an online archive. Having reached The Telegraph and The Guardian (The Torygraph and The Grauniad) by this series of restrictions seems quite fortuitous. It could equally be a result of the shared styles, formats and interests of these titles. There is however some breadth in this spectrum even if it is mostly self-proclaimed. By their own descriptions and in the crudest of terms these papers position themselves as right and left-wing respectively.

### **3.1 Survey Parameters**

The period that I have nominated to study runs from January 1st 2001 to December 31st 2002. The style of analysis that I describe here required that each story was read thoroughly, in skim reading it would have been far too easy to miss key sentences. The precarious nature of examination of facets such as tone means that an in depth analysis of survey has had to be balanced with sample size. There were several key events in genetics during this period both within the field itself and from without, concerning its regulation. There was even the Ralien report of the first successfully cloned baby - whatever the reliability of this group the event still provides an excellent opportunity to examine the way this was reported. Hopefully this period will be long enough to give an overview of the development of coverage in this area and a description of current trends. As indicated previously my choice of titles has already been delineated by other factors, hopefully without detriment to relevancy. Within these titles I intend to select relevant stories through text searches under the words, 'genetics and DNA'. The use of both these words will hopefully eliminate more spurious results that only make passing reference to genetics or DNA individually. Obviously in the process of reading through stories less relevant pieces will also become apparent. These will be discarded on the basis that only articles with content based in the main around genetics will be included. Therefore reports on the hunt for a notorious serial killer will not be included simply because DNA fingerprinting techniques have been used. If however the crux of the story is the fingerprinting technique the article would be included.

Unfortunately by using the archive search engines provided by these two newspapers I am at the mercy of their abilities to function. However this should not be too detrimental, this study is more about the information provided to the public than total published content. By using the archive searches provided I am in effect in the same position as any other member of the public wishing to find out about genetics.

I will attempt to ground the analysis of chosen stories in quantitative observation in the first part of the survey and then expand to a more qualitative interpretation in the second. The first level of survey will assess overall number of stories, length in words, regularity of appearance, number of sources used and temporal proximity to significant events within the field. Temporal proximity will here be gauged as classification into 'news'; stories which report some new or breaking event, 'background'; stories which provide information although little or no

novelty or 'opinion'; stories which have been written with a specific a priori stance in mind. Number of sources cited can be quantified and hopefully provide some gauge as to the breadth of research undertaken in writing a given piece. Unfortunately space does not allow here for an assessment of the level of involvement of sources. It would in any case be fairly tricky if not inaccurate to try and label the level to which people hold their convictions. The number of directly quoted and credited sources will be used here as these are the only sources which can be readily verified. Regularity, size and quantity of pieces all provide themselves readily for quantification; however it is worth noting that there is some distinction to be made here between supplement coverage and main paper stories. This should fall out in the definition of stories into news, background or opinion as most news pieces will appear in the main paper and most of the latter two groups will appear in supplements. This part of the analysis will go some way to describing the technical infrastructures identified by Hall and described in section 1.6 above.

The second level of inquiry will assess the amount of specific terminology used, the presence of recurring metaphors and overall tone of the piece i.e. positive, negative or neutral. Much of the motivation for this inquiry into the use of terminology is drawn from Berube's work cited previously. Terminologies are defined here as words specific to genetics and unlikely to be seen in other contexts. Metaphors have also been given a restricted definition here, that is only those that pertain to genetics in general will be assayed. Metaphors used to describe specific processes while sometimes problematic have far less influence on the communication of genetics as a whole.

Obviously this is where quantitative analysis becomes much more problematic. To an extent the recurring terminologies and metaphors used will reveal themselves in the stories as they are analysed. This will then be used to identify key terms, so if enzyme is used repeatedly both in and across articles it will become a category on which articles are scored. Similarly if genetic manipulation is repeatedly called tinkering with life a category for this metaphor will be created. I suspect here that the analysis of terminology will focus on term's used and their regularity in individual pieces whereas the analysis of metaphor will hinge more on presence across stories.

This type of analysis is intended to do two things firstly to discern the level of abstraction created in coverage but also, secondly and as importantly it will give some indication of the way in which stories become biased. A dense and technical or

'scientific' piece it might be assumed would by its nature become biased towards the scientist. Whether this proves to be the case or not might give us an indication of the way in which news stories become 'phrased' or biased towards the various characters contained within the m. The most difficult part of this level of analysis will be discerning tone of the stories accurately. This will be done here with the same key word approach; at the end of the survey key words used will provide a basis for scoring articles. Those which use negative key words will be scored at zero, those using positive key words, two and those employing a mixture or neither, 1 indicating neutrality. These scores may then be averaged to gauge tone across all articles or within defined subsets. The accuracy of this approach however remains to be seen.

The third and last level of analysis will try to quantify the way in which the article relates the science reported to the wider social economy. While some pieces will stress economic benefits, others may relate the importance of this science to athletes or other groups and still others might explore the impact on the media. The categories that this analysis will segregate the sample into will be inferred from the articles themselves in part and also derived from Appadurais' literature as described above. Economic, technological, ideological, media or ethnic based interpretations and representations of science are handy categories for pigeon holing stories. These are not however exclusive and I would like to maintain a similar reflexivity to that adopted over selecting key words as above. Some articles will address a number of different ways in which the science will be important and this will also be quantified. My interpretation of these results will focus on trying to discern the features of the current model or models of analysis and in the case of multiple models the possible prevalence of one model over others.

The analysis of each story will be based on the following template:

Title / Date:

Author:

Length:

News / background / opinion:

Number of sources:

Specific terminology used: i.e. phenotypic 1/ geneotypic1, enzyme5 etc

Presence of metaphors:



Tone - key words:

Connection to wider society - key words:

This will be followed by a brief description and analysis of each piece. The raw data generated in the form of these crib sheets will not be included in this report in hard copy form but as word documents stored on data CD. This is because of space constraints; each document is in excess of fifty pages and would add considerably to the total length of the report. However I would like to include this raw data both as an indication of the way in which this survey has been conducted (the template sheets are easily referable to the appropriate achieve article) and as a resource for further investigation of other features of the data set which it is not possible to touch on here.

### **3.2 Interviews**

The second part of this survey aims to elicit more specific response from individuals affected by the process of science communication described in the introduction. To this end I will interview a representative selection of journalists and scientists. The selection of whom to interview is obviously a limiting factor on the responses gained and for this reason candidates for interview have been specifically nominated. To represent journalistic contribution to the communication process the science editors for the two newspapers surveyed will be interviewed. To represent scientific contribution two scientists will be interviewed, Prof. Alan Handyside and Prof. David Cove. Although they less immediately obvious candidates than the two science editors – who by their jobs are implicated directly, I believe these two Professors represent a very interesting position in this field. Both have had previous experience of interacting with the press but whereas David Cove is a mainly research based scientist Alan Handyside is also a practicing embryologist in a private clinic. While this does not entirely cover the opposition between private and publicly funded scientists I believe it starts to give an indication of the differences between science communications from the two areas. While the results of these interviews cannot be taken as direct proof for anything they can be used to reference with arguments drawn from the results proper. Hopefully they will be able to instruct and inform my discussion and interpretation of the results.

The interviews will be based around different questions reflecting the differing interests of the interviewees; however they have been directly linked in each case to facets of the media survey.

All of the interview transcripts have been returned for editing to the interviewees, although none of them have taken up this opportunity. In the case of Roger Highfield's interview time constraints resulted in it's being conducted by email. Because of space constraints, most of the interviews ran to over an hour, the transcripts will not be reproduced in the results section but placed in the appendices.

### **3.0 Results**

Throughout the results figures showing data for the Guardian are annotated as **Fig Gn** and those showing data for the Telegraph as **Fig Tn**. The label **Fig GTn** indicates that both the Telegraph and Guardian data is displayed in the figure.

The Guardian;

Total number of articles = 182

On average 1 article printed every 4 days

Total amount of coverage = 172016 words

Average length of article = 945 words

Average number of sources cited per article = 2

Average amount of terminology used = 3.6 words

Average tone of articles = 1.09 (0 = -neg, 2 = +pos, 1 = neutral)

The Telegraph;

Total No of articles = 136

On average 1 article every 5 days

Total amount of coverage = 90998 words

Average length of article = 669 words

Average number of sources cited per article = 1.4

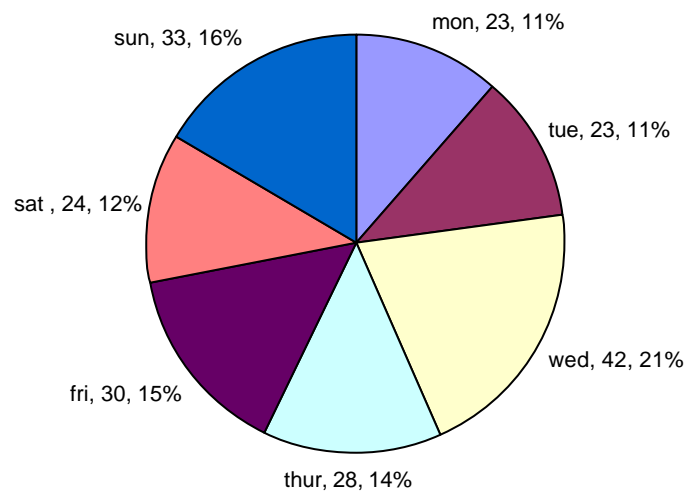
Average amount of terminology used per article = 3.8 words

Average tone = 1.4 (0 = -neg, 2 = +pos, 1 = neutral)

The figures shown here represent a rough analysis of the volume of coverage, the regularity of coverage and some indicators as to content. The data sets generated here only really become significant in comparison to each other. These results are a rough first summation of the Guardian and Telegraph's coverage. In themselves they don't give us a great deal more than an outline of the entire coverage. In comparison to each other though, these figures might be much more instructive. It is worth noting that the average tone is very close to neutral for total coverage in the Guardian but much more positive for the Telegraph.

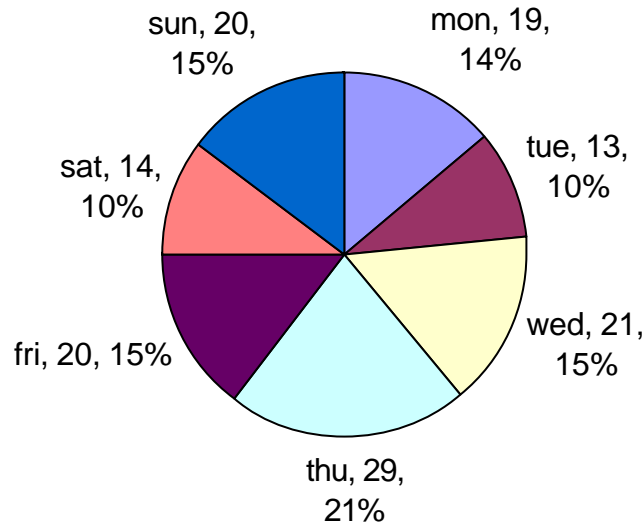
In the Guardian data set beyond DNA and genes (the two most frequently used terminologies) at least one other terminology is usually used. Two sources are usually quoted, although whether these represent positive and negative positions is not made clear by my data. One article published every four days indicates that science coverage is not strictly limited to specialist articles in a weekly supplement. Considered in combination with the pie chart shown below this indicates that a science article might be published on any day of the week. However a greater proportion of stories are published on a Wednesday than any other day of the week obviously the data set does not infer why this might occur.

**Numbers of stories published on individual days**



**Fig G1** Pie chart indicating how many stories are published on any individual day, labels give total number of articles to published on a given day and percentage of coverage this constitutes

**Number of stories published on individual days**



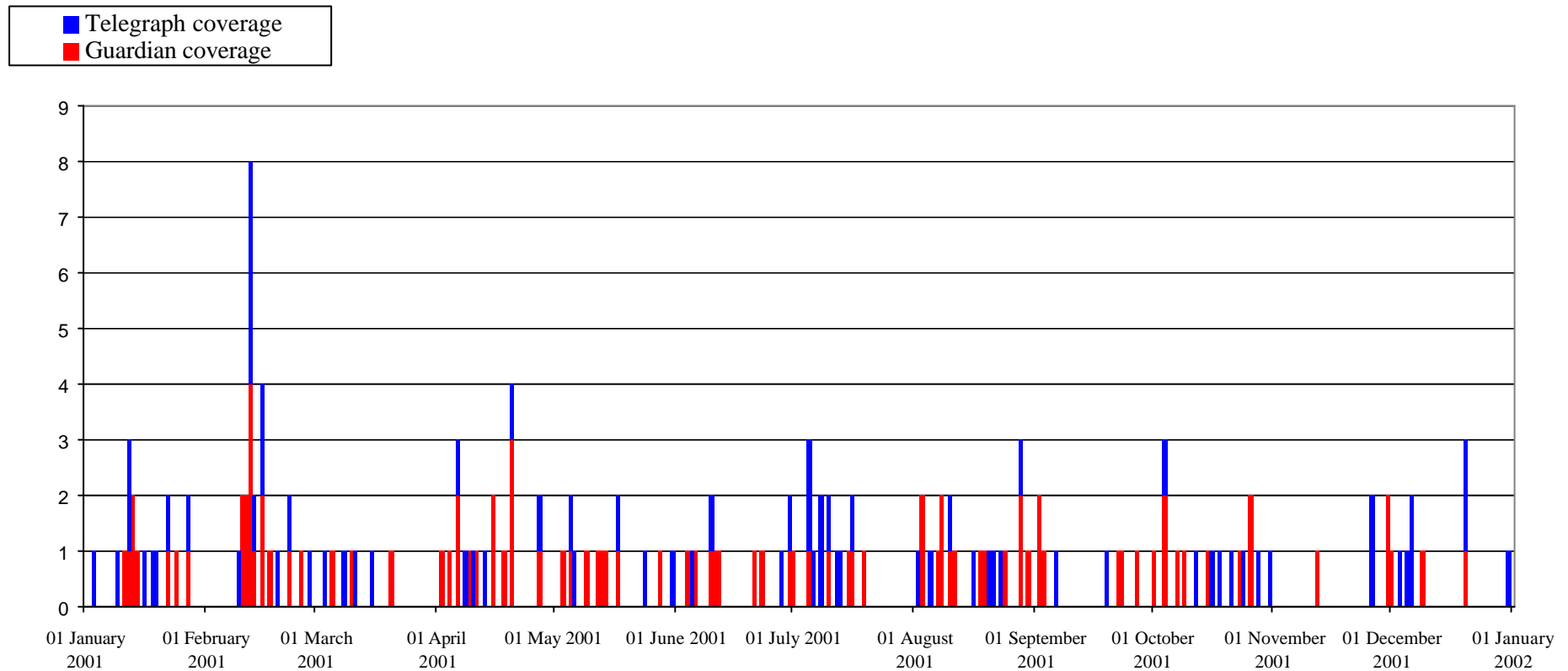
**Fig T1** Pie chart indicating how many stories are published on any individual day, labels give total number of articles to published on a given day and percentage of coverage this constitutes.

A similar analysis of the Telegraph indicates that on average more terminology and fewer sources appear in the Telegraph’s articles than in the Guardian. The pie chart above indicates that again articles relating to genetics might appear in the Telegraph on any day but that a higher proportion of articles appear on a Thursday. A more specific temporal analysis of coverage can be seen in the next three figures

	2001	2002
Telegraph	75	61
Guardian	94	88

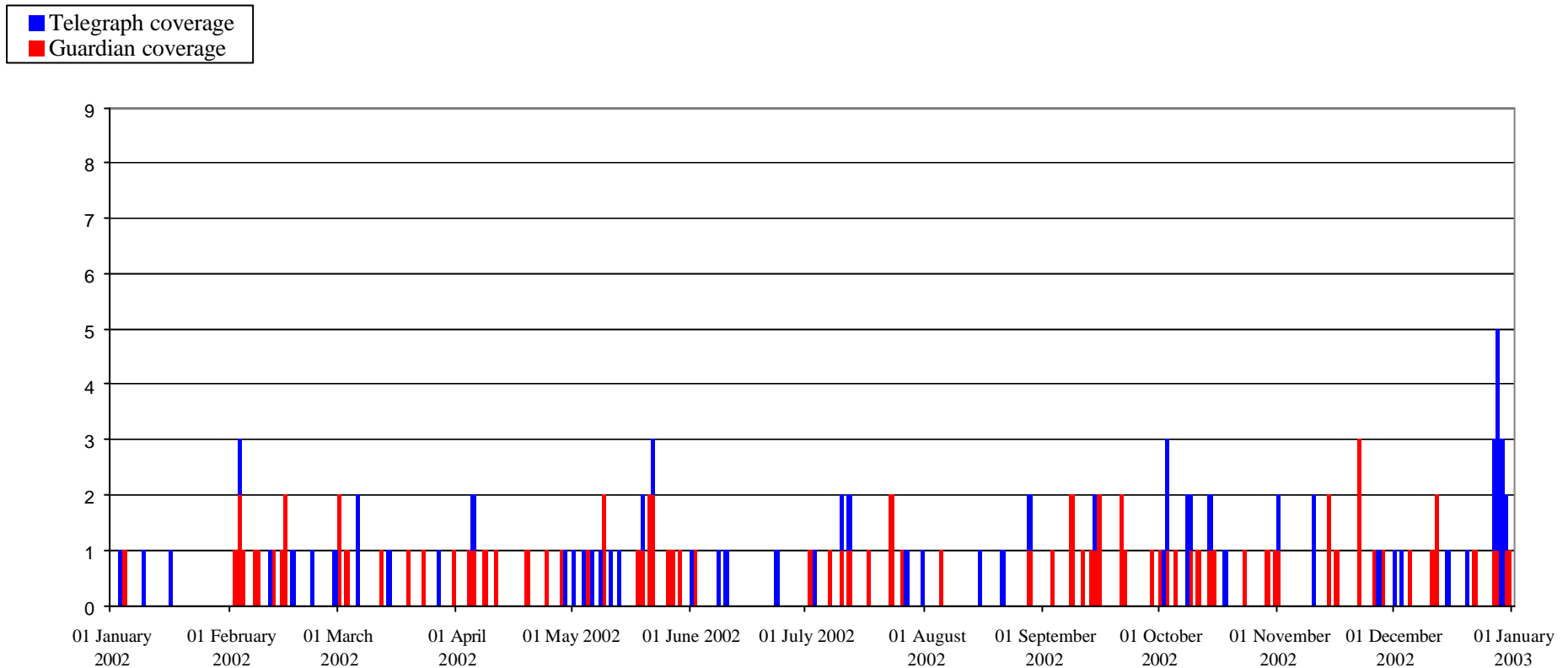
**Fig GT1** Table shows number of stories published in each year by each newspaper.

## Bar Chart showing distribution of coverage over 2001



**Fig GT2** This bar chart shows temporal distribution of stories through 2001. Both news papers outputs have been recorded (see legend for colour key) and coverage is indicated cumulatively for each day i.e. one column represents any day on which a news story was published, height indicates number of news stories published on that day and colour represents publisher of article.

## Bar Chart showing distribution of coverage over 2002



**Fig GT3** This bar chart shows temporal distribution of stories through 2002. Both news papers outputs have been recorded (see legend for colour key) and coverage is indicated cumulatively for each day i.e. one column represents any day on which a news story was published, height indicates number of news stories published on that day and colour represents publisher of article.

Upon first inspection of figures GT2 & 3 it appears that the articles are clumped around specific days. It might be assumed that these were significant events around which coverage clustered. A ‘runs’ test<sup>(33)</sup> was carried out to assess whether articles were randomly temporally grouped or clumped, presumably around news stories. The test statistic 0.413627 generated for the Guardian data set indicated that at the 5% level we should retain a null hypothesis of randomised article distribution. When a similar test was run on the Telegraph data set the test statistic 1.646043 generated indicated that at the 5% level we should retain a null hypothesis of randomised article distribution for the Telegraph’s coverage too although this figure is much higher than the Guardian’s in the equivalent test.

The results in the next sections concentrate in more detail on the constituent elements of articles and their relation to each other. It is interesting to have some data though which gives a more global view of science coverage and a better starting point for comparison. The next sections will hopefully give more specific information on the mode of coverage.

### **3.1 Analysis by article type**

In this section I have tried to focus the results gained around the categorisation of articles by type as explained in the methodology. This again relates to the temporal distribution of coverage, ‘News’ relates to that coverage most specifically linked to events, and therefore clumped with the coverage of other newspapers. ‘Background’ and ‘Opinion’ can effectively be published at anytime, unless they are a direct response to a specific event. The problem here was that these three categories failed to capture all article types, in particular those news stories with heavy background content. To include this type of story in the analysis and hopefully gain a more accurate representation the three categories have been extended here to six. The three new categories provide some representation of those articles in which type is blended. It is worth noting that these three new categories while significant do not cumulatively represent more than 10% of total coverage.



2001/2002

	News	Background	Opinion	N+B	B+O	N+O
total	54	79	31	9	8	1
%	30%	43%	17%	5%	4%	1%
Mean length	558.56	1083.13	1011.13	633.11	2333.13	579
st. dev	309.64	1153.39	475.08	455.04	2523.81	0

2001

	News	Background	Opinion	N+B	B+O	N+O
total	20	48	17	3	5	0
%	22%	51%	18%	3%	5%	0%
mean length	564.75	1147.92	887.71	638	2560.8	579
st. dev	391.47	1317.07	412.18	704.09	2808.65	0

2002

	News	Background	opinion	N+B	B+O	N+O
Total	34	31	14	6	3	1
%	38%	35%	15%	7%	3%	1%
mean length	554.91	982.81	1161	630.67	1953.66	579
st. dev	256.35	850.90	517.34	364.66	2484.17	0

**Fig G2** Table shows breakdown of coverage into categories News, Background, Opinion, News and Background (N+B), Background and Opinion (B+O) and News and Opinion (N+O). Coverage categorised in total number of stories in each type both in total and by year. Mean length of stories in words shown with standard deviation.

2001/2002:

	News	Background	Opinion	N+B	B+O	N+O
total	52	45	24	7	8	0
%	38%	34%	18%	5%	6%	0%
Mean length	463.29	738.73	722.38	823.86	1348.13	0
st. dev	176.74	421.23	337.44	460.83	709.62	0

2001:

	News	Background	Opinion	N+B	B+O	N+O
total	20	23	13	1	4	0
%	33%	38%	21%	2%	6%	0%
Mean length	467.55	747	663.77	751	892.75	0
st. dev	182.15	468.44	290.38	0	133.29	0

2002:

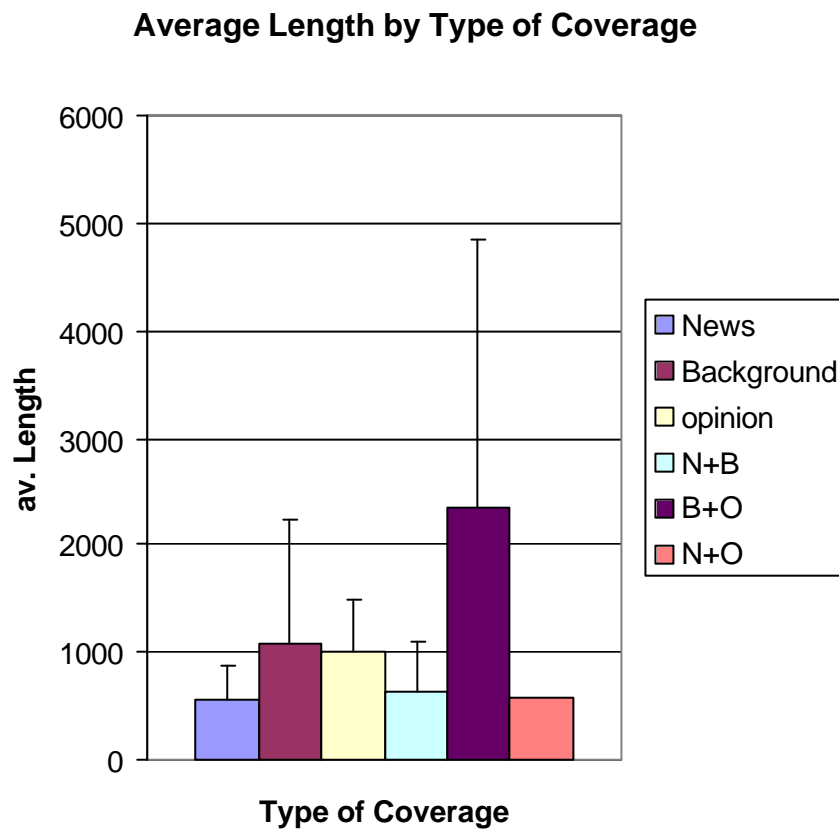
	News	Background	Opinion	N+B	B+O	N+O
total	32	22	11	6	4	0
%	43%	29%	15%	8%	5%	0%
Mean length	451.41	730.09	791.64	836	1803.5	0
st. dev	175.93	376.46	388.55	503.59	777.33	0

**Fig T2** Table shows breakdown of coverage into categories News, Background, Opinion, News and Background (N+B), Background and Opinion (B+O) and News and Opinion (N+O). Coverage categorised in total number of stories in each type both in total and by year. Mean length of stories in words shown with standard deviation. Note the News category is the most tightly bunched within 1 SD to a uniform length

The differences between coverage types from year to year should be noted here as should the standard deviation from story size. Both give an indication of the way in which stories are first generated and secondly made to specify, a lower standard deviation showing more uniformity and therefore a greater probability that editorial constraints are placed on the length of certain story types.

There is an interesting shift in story types in both data sets between the two years. It appears that both newspapers contributed more news than background in 2002 relative to 2001, this might be linked with the shift in tone discussed later on.

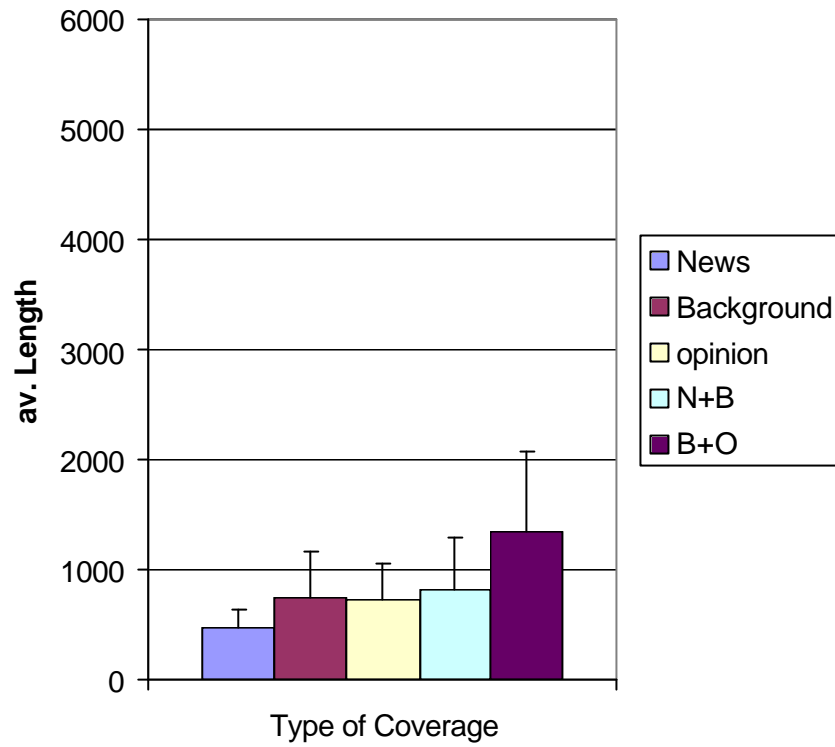
The next four figures provide a graphical description of the data shown in the two tables above. Note that the y axis on both figures G3 and T3 are of corresponding length, the difference in the two graphs indicates the greater volume of output that the Guardian provides in this area.



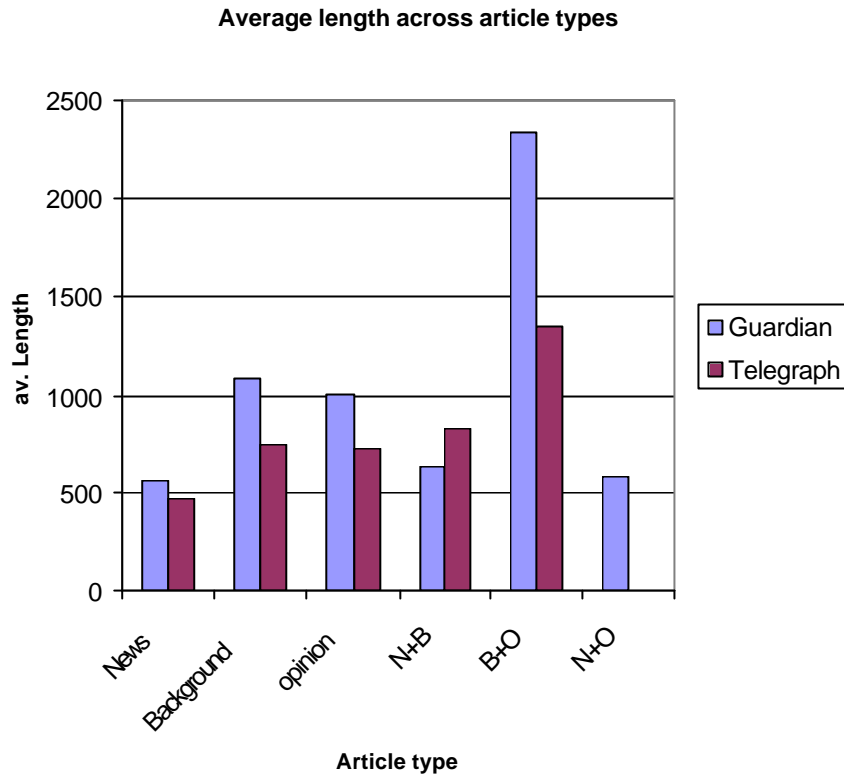
**Fig G3** Bar chart showing average article length in each story type and standard deviation. Coverage type categorised into News, Background, Opinion, News and Background (N+B), Background and Opinion (B+O) and News and Opinion (N+O)

The difference between figures G3 and T3 may be most instructive about the constraints placed on stories of a certain type, in both data sets News and Opinion are the most uniformly sized article types. There is however far higher uniformity across article types in the Telegraph’s data set (**fig T3**).

**Average Length by Type of Coverage**



**Fig T3** Bar chart showing average article length in each story type and standard deviation. Coverage categorised into News, Background, Opinion, News and Background (N+B), Background and Opinion (B+O) and News and Opinion (N+O). The series N+O is not present in this bar chart as it is in figure G3 above simply because no stories of this type were discerned from the Telegraph data set.

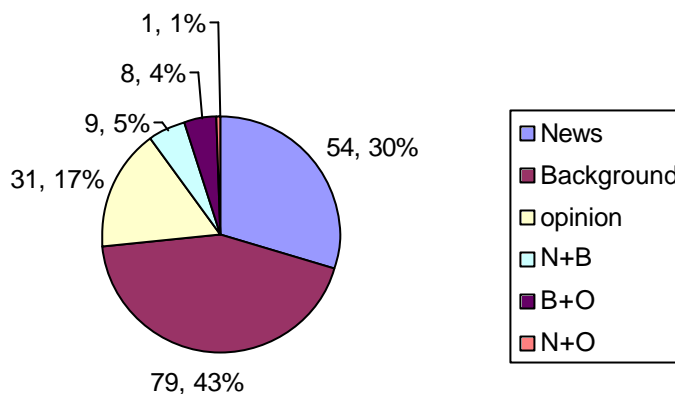


**Fig GT4** Shows mean lengths of articles in different types in both newspapers. Coverage categorised into News, Background, Opinion, News and Background (N+B), Background and Opinion (B+O) and News and Opinion (N+O).

This figure makes obvious once again that the Guardian publishes more articles about genetics across all story types

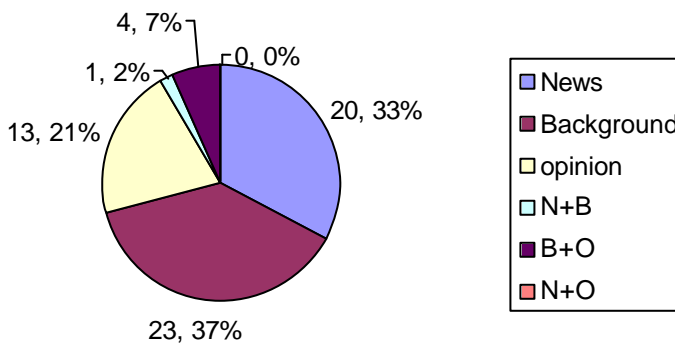
The pie charts below clearly indicate that for all coverage divided by type the bulk of coverage is made up of background type stories. Reference to figures G2 & T2 shows that this was even more pronounced in 2001 but quite untrue in 2002 when more news stories were published by both newspapers.

**Total coverage divided by type**



**Fig G4** Pie chart shows breakdown of total coverage by type. Values and percentages are shown. Coverage categorised into News, Background, Opinion, News and Background (N+B), Background and Opinion (B+O) and News and Opinion (N+O).

**Total coverage divided into type**



**Fig T4** Pie chart shows breakdown of total coverage by type. Values and percentages are shown. Coverage categorised into News, Background, Opinion, News and Background (N+B), Background and Opinion (B+O) and News and Opinion (N+O).

### **3.2 Analysis of use of sources**

In total:

Background	opinion	News	B+O	N+B	N+O
2.27	0.87	2	4.63	1.67	3

2001:

Background	opinion	News	B+O	N+B	N+O
2.31	0.53	1.85	5	1.75	0

2002:

Background	opinion	News	B+O	N+B	N+O
2.19	1.29	2.09	4	1.6	3

**Fig G5** Average number of sources used in each article type, in total and by year.

This analysis of use of sources is instructive of the number but not the type of source used. It is also obvious that the last three categories derive their average number of quoted sources from a much more limited data set than the first three categories. As a result the average number of sources quoted in B+O reflects the extremes of the data set where as this effect is diminished in the first three categories by sample size. It seems that for both newspaper's data sets in the three main article types Background articles generally use the most quoted sources, News the second most and Opinion the least. This is not necessarily logical as Opinion is just as likely to need correlative sources as any other story type. This may reflect a trend to publish Opinion stories which contain only one standpoint. Interestingly the stories which blend background and opinion or news and background contain some of the highest source counts.

In total:

Background	Opinion	News	B+O	N+B	N+O
1.51	0.67	1.5	1.75	2.14	0

2001:

Background	Opinion	News	B+O	N+B	N+O
1.73	0.91	1.41	1.41	2	0

2002:

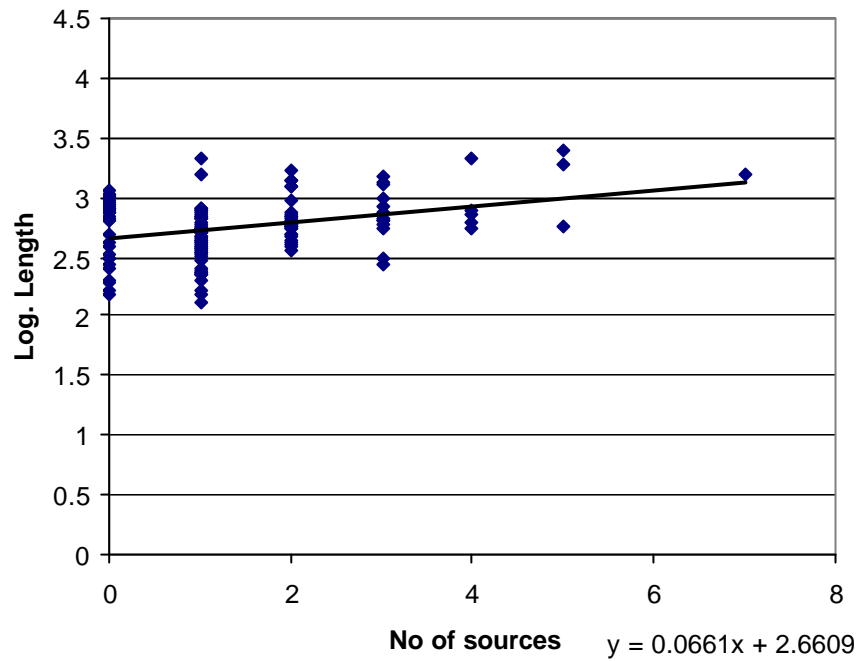
Background	Opinion	News	B+O	N+B	N+O
1.30	0.46	1.65	0	3	0

**FigT5** Table shows average number of cited sources used in each story divided by same categories shown in Fig T2. Data is shown in total and by year.

In the graphs shown below length is linked to number of sources quoted. Note that length scores have been transformed to Log 10 scores of length to standardize the data sets. The p-values generated by regression are also shown and indicate a positive correlation between the two variables in both newspapers. The relationship is only correlative though as far as these data sets can predict. This analysis also acts as an intuitive control, the results represent that which could be expected, although it is not set in stone that longer articles will use more quotes. Seeing such a relationship supported by my data does however indicate that the sampling methods are at least operating in a manner that might have been expected.

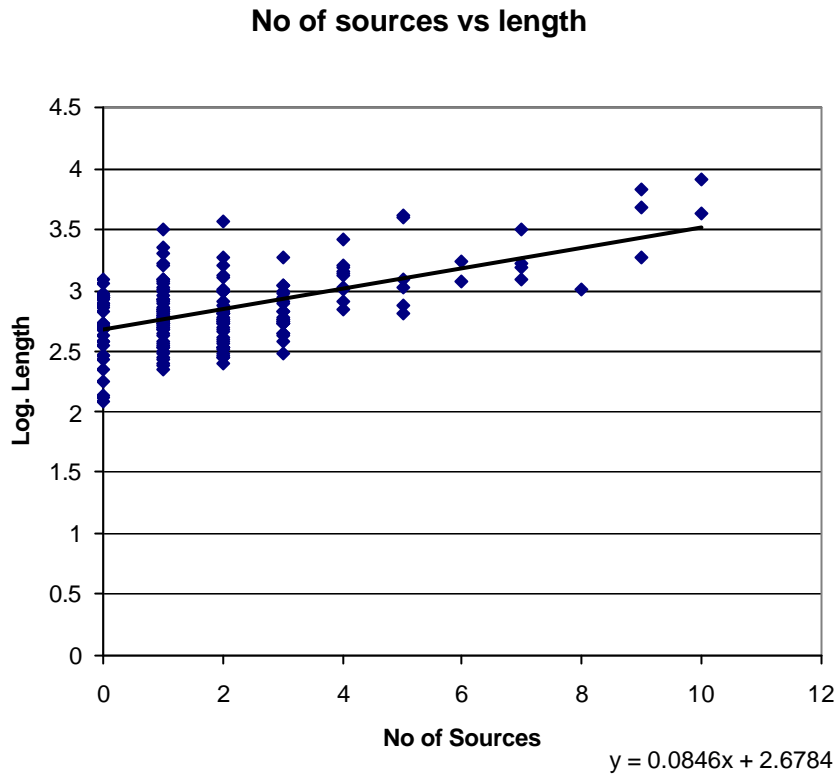


No of Sources vs. length



	<i>Standard</i>			
	<i>Coefficients</i>	<i>Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.660879	0.030424	87.45862	4.5E-120
X Variable 1	0.066061	0.016045	4.117257	6.67E-05

**FigT6** Graph shows relationship between number of sources and log lengths of story, as might be expected an increase in sources cited correlates with increasing length. Presumably the uniform lack of cited sources in opinion pieces has the effect of retarding this relationship, skewing the graph towards longer pieces with fewer sources.



	<i>Standard</i>			
	<i>Coefficients</i>	<i>Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.678436817	0.026245738	102.0523	3.1193E-161
X Variable 1	0.084575008	0.009120903	9.272657	5.64756E-17

**Fig G6** Relationship of number of sources cited to log length of story. Also shown is p-value score.

### **3.3 Analysis of terminology**

Total	2001	2002
Term av.	Term av.	Term av.
3.62	3.91	3.31

**Fig G7** Table shows average number of terminology used in total and in each year.

Total	2001	2002
Term av.	Term av.	Term av.
3.82	3.92	3.69

**Fig T7** Table shows average number of terminology used in total and in each year.

This brief description of use of terminology indicates that although the Telegraph might use slightly more scientific descriptions in articles the difference is very small, being less than one whole word.

### **3.4 Analysis of use of metaphor**

It quickly became obvious that this part of the survey will remain unfocused unless large quantities of semiotic analysis are imported from elsewhere. As result the figures shown here go a little way to indicating presence or absence of metaphor but only touch on use of metaphor in the vaguest way. Only 34% of all stories in the Guardian actually contained metaphors and in those that did an average of 1.41 metaphors were used. In the Telegraph's coverage metaphor is used in 29% of articles and those articles that use metaphors use an average of 1.5. Those metaphors which occurred more than once in each news paper are shown in the table below; the full metaphors used are recorded in the CD's included in appendix 5.

	The discovery of the wheel or fire	Frankenstein	Book of Life
Guardian	3(5%)	6(10%)	7(11%)
Telegraph	0	2(5%)	9(23%)
	Brave new world	Blue print/recipe/map	Playing God
Guardian	2(5%)	4(7%)	3(5%)
Telegraph	0	5(13%)	1(3%)
	Milestone	Mumbo jumbo voodoo	Spectre of eugenics
Guardian	1(2%)	0	0
Telegraph	2(5%)	2(5%)	2 (5%)
	Designer Babies	Needle in a haystack	Death genes/Methuselah genes
Guardian	3(5%)	2(3%)	1(2%)
Telegraph	3(8%)	0	2 (5%)

**Fig GT5** Summary of metaphors which appeared more than once in either newspaper, numbers given are totals for use of this metaphor across all stories. Percentages shown indicate what part this metaphor constituted to overall metaphor use.

### **3.4 Analysis of tone**

2001	2002
tone -av.	tone -av.
1.23	0.93

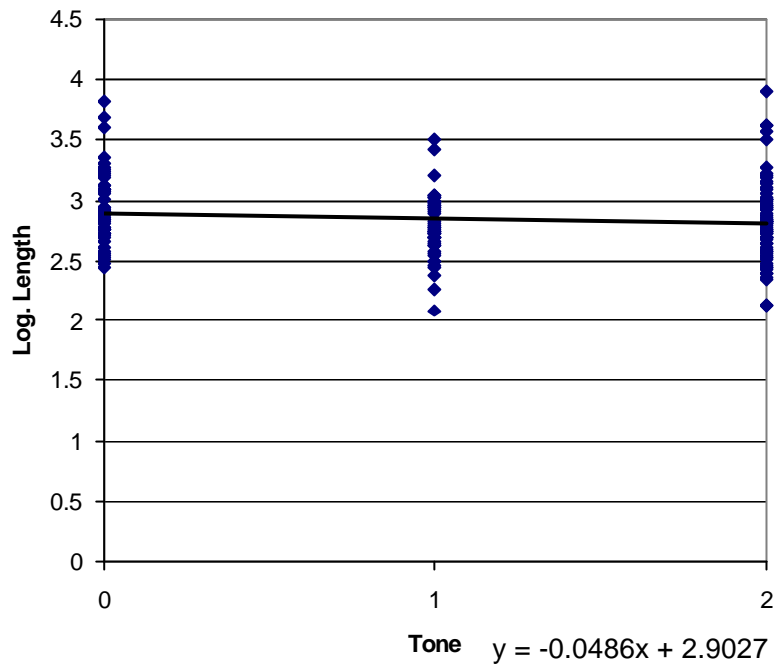
**Fig G8** Average tone across all articles in each year. Standard deviation from the total figure for both years (1.09) is 0.8.

2001	2002
tone - av.	tone - av.
1.44	1.44

**Fig T8** Average tone across all articles in each year Standard deviation from the total figure for both years (1.4) is 0.7.

Of interest here is the difference between tones over the two years, while the Guardian seems to have become more negative in its reportage over the two years the Telegraph's tone has remained constant. It is worth remembering that across all articles the figure given here for tone is a rough estimate.

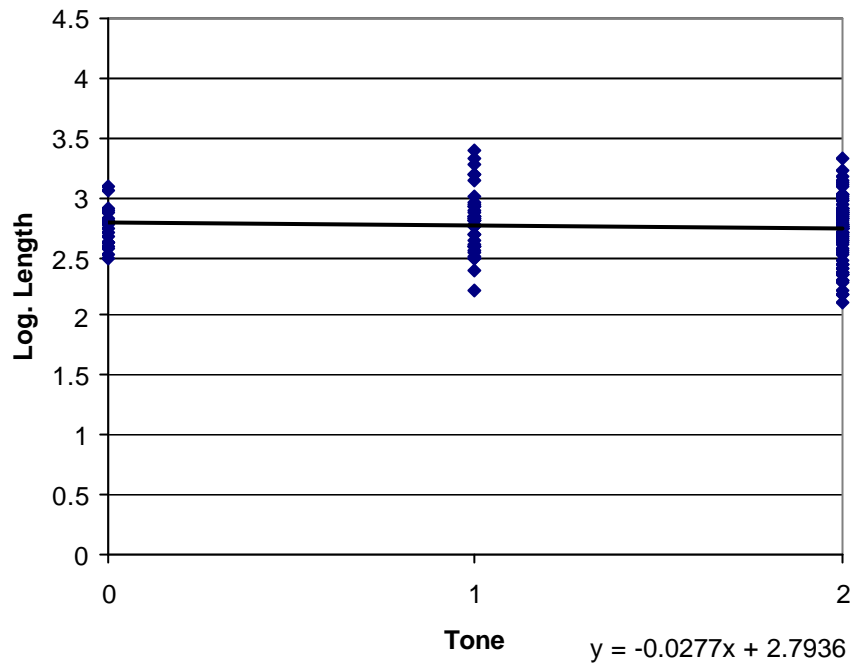
Tone vs. Length



	<i>Standard</i>			
	<i>Coefficients</i>	<i>Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.902745361	0.036511604	79.50199	3.8783E-142
X Variable 1	-0.048565541	0.026480645	-1.834	0.068304958

**FigG9** Graph showing relationship between tone and length of stories. Again lengths have been transformed to log scores. P-value is shown in table below graph

Tone vs. Length

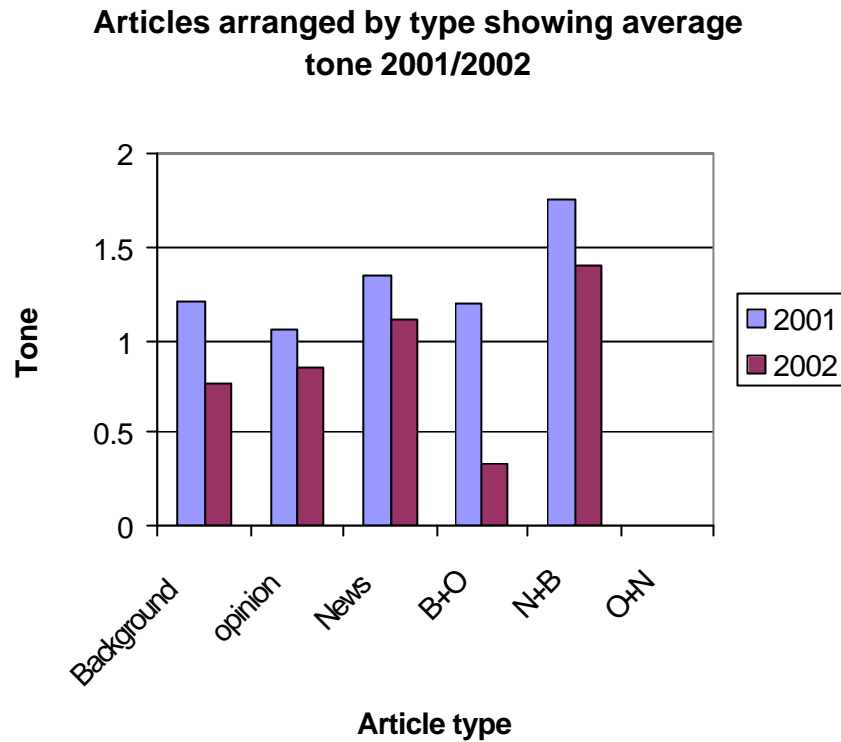


	<i>Standard</i>			
	<i>Coefficients</i>	<i>Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.793572944	0.048112543	58.0633	7.33E-97
X Variable 1	-0.027697477	0.02982127	-0.92878	0.354672

**Fig T9** Graph showing relationship between tone and length of stories. Again lengths have been transformed to log scores. P-value is shown in table below graph

Suspicious that different article types as identified in 3.1 also correlated to different tones of reportage, this analysis of tone vs. length was undertaken. Length here roughly represents different article types (news being significantly shorter on average than background or opinion coverage). Interestingly the p-value generated by regression analysis for the Guardian data set indicates no correlation between the two factors at the 0.05 level, whereas the regression for the Telegraph data set indicates there is a relationship here. In the Guardian’s case this contrasts with the bar charts shown below which indicate that there is a difference between the tone of different article types and what is more this has changed over the two years. The fall in tone

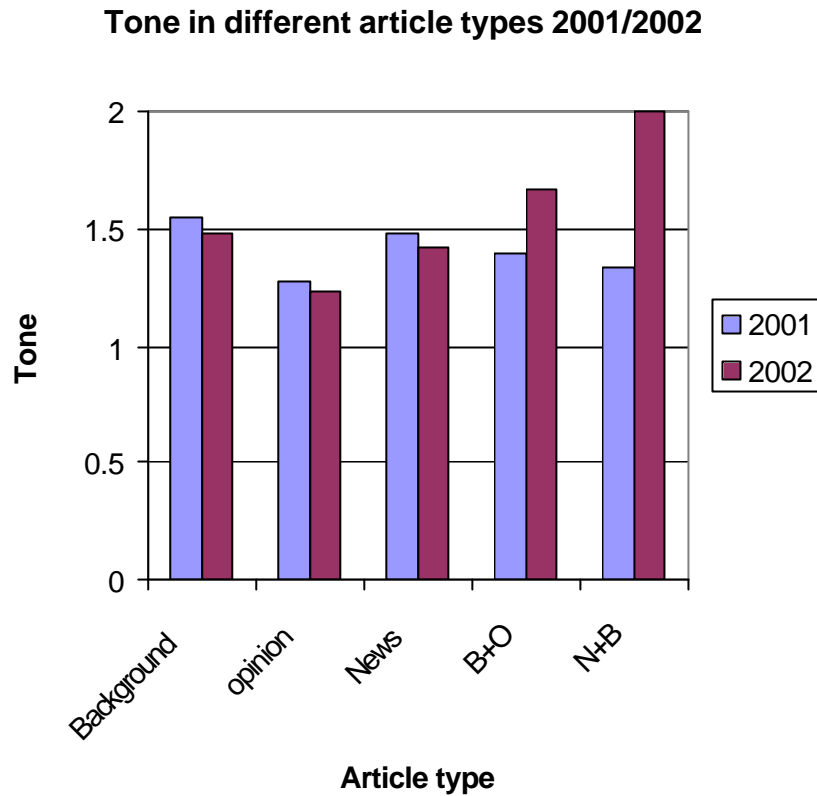
from positive to more negative across article types corresponds to the fall in average figure for tone across all articles in each year seen in figures G8 and T8



**Fig G10** Bar chart showing average tone in each article type over both years. Coverage categorised into News, Background, Opinion, News and Background (N+B), Background and Opinion (B+O) and Opinion and News (O+N).

This bar chart indicates the fall in tone across Guardian article types from 2001 and 2002, it also indicates that in both years different article types have different average tone. In the equivalent graph for the Telegraph data set, shown below, we can see that although tone did drop from one year to the next in the news, opinion and background categories this was offset by the increased positive tone of stories which blended background and news or opinion.



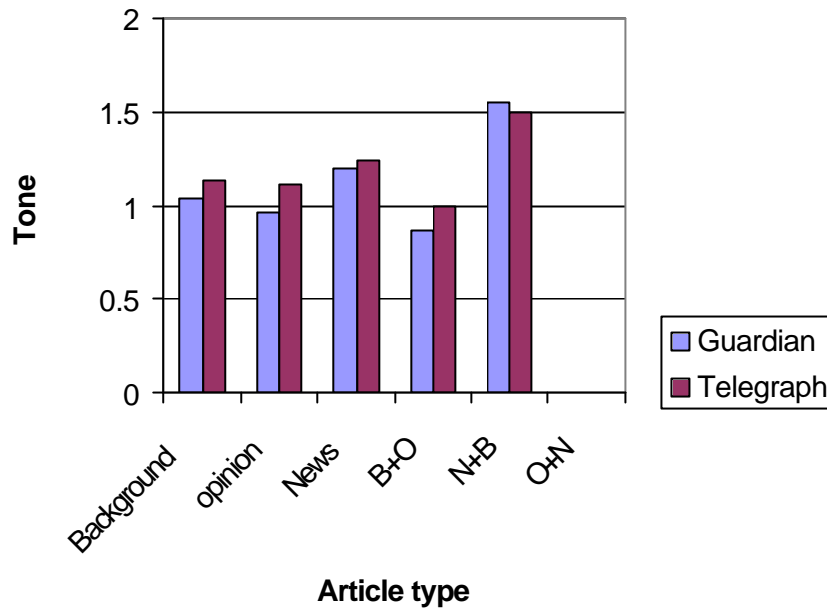


**Fig T10** Bar chart showing average tone in each article type over both years. Coverage categorised into News, Background, Opinion, Background and Opinion (B+O) and News and Background (N+B).

The bar chart above indicates not only the changing tone across years but also the relative tone of each article type. In the Telegraph’s coverage opinion stories have the most negative tone on average in both years. In the Guardian’s coverage opinion stories initially have the most negative tone however in 2002 this is changed as news stories now have the lowest average tone.

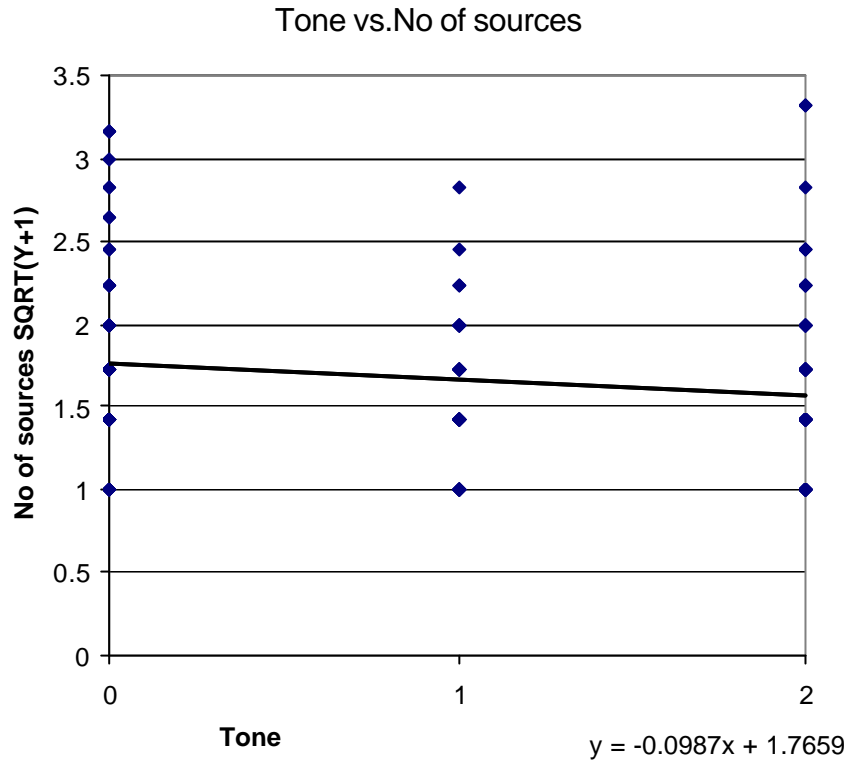
The contrast in tone between various article types and across both news is explored in more detail in figure GT4 below. It is worth noting that on average the Telegraph is more positive across all article types except those which blend news with background. It is possible though given the general trend in tone that this is an artefact produced by the limited data set generated for this article type.

**Total coverage for both titles showing tone for different article types**



**Fig GT6** Bar chart shows tone indifferent article types for each newspaper Coverage categorised into News, Background, Opinion, News and Background (N+B), Background and Opinion (B+O) and Opinion and News (O+N).

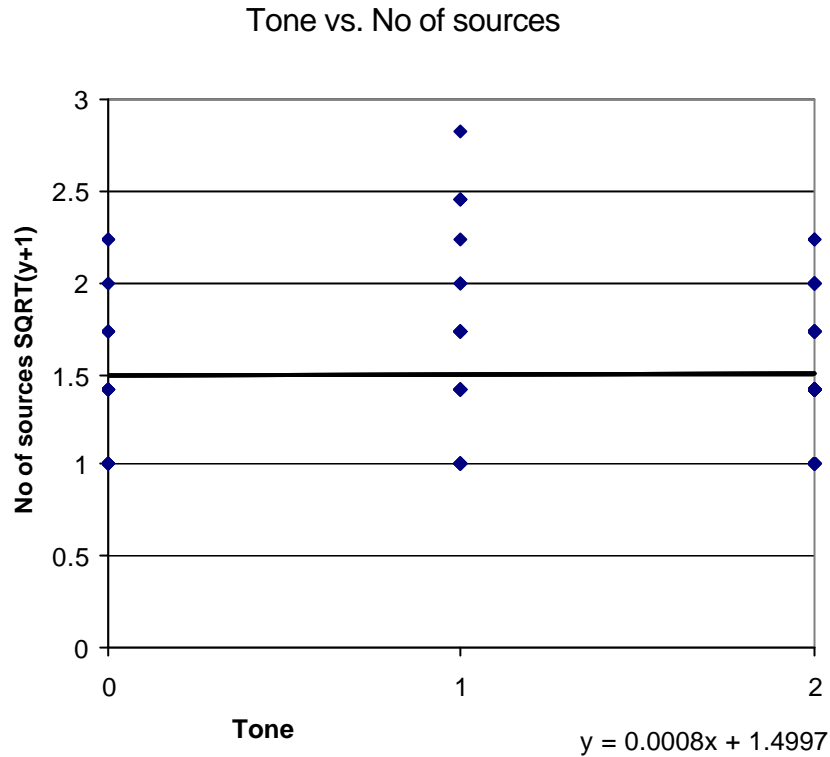
In the analysis of number of sources against tone shown below, the number of sources is transformed as this data represents a count. The p-value in figure G10 indicates that there is a negative correlation between the two variables here, less sources usually corresponds to a more positive tone in the Guardian data set. The p-value given in figure T10 indicates however that no such relationship exists for the Telegraph data set; this would infer that the use of sources is independent of the length of article. That the two data sets show different relationships or lack of them between sources used and tone indicates that while number of sources may be allowed to extend story length (or correspondingly that greater length may demand the use of more sources) there is no direct relationship of causation, this is assuming that there is no specified editorial rule governing use of sources at either newspaper.



	<i>Standard</i>			
	<i>Coefficients</i>	<i>Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	1.765871747	0.06302538	28.01842	1.5267E-67
X Variable 1	-0.098696807	0.045710199	-2.15919	0.032159199

**Fig G11** Graph shows relationship between number of sources and tone, table shows the relevant p-values.

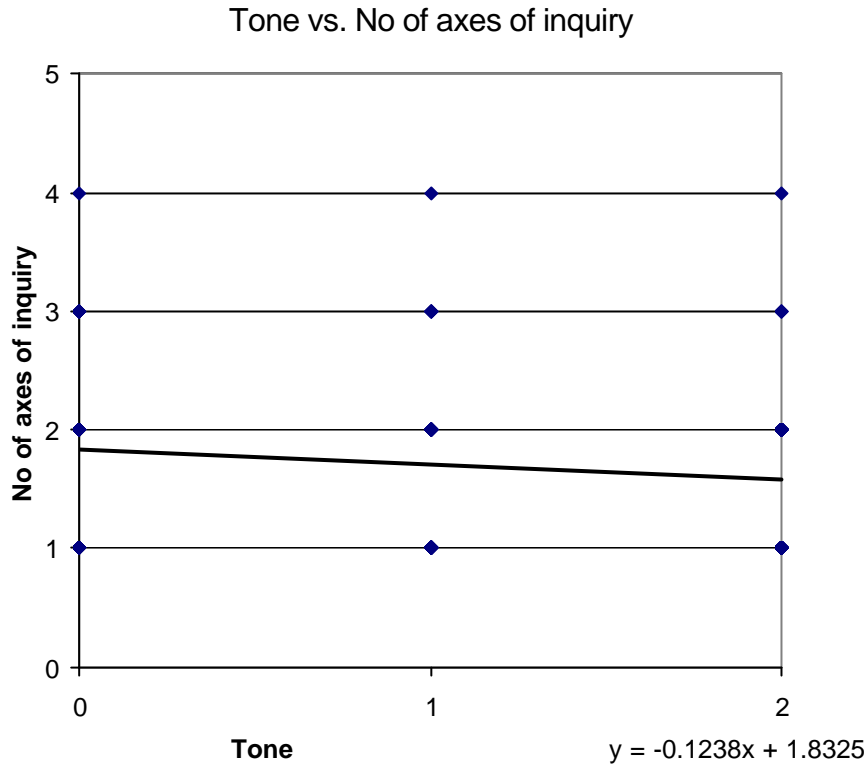
This result and predicted relationship may also be the consequence of more generalized trends indicated earlier. The Guardian uses more sources on average and writes in a generally more negative tone, the relationship seen here between the two newspapers may simply reflect this difference. Within the Guardian’s coverage though, the p-value does indicate a significant relationship between the two factors, a similar relationship may not be obvious because the Telegraph’s coverage is more uniformly positive across all article types.



	<i>Standard</i>			
	<i>Coefficients</i>	<i>Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	1.499733683	0.074835377	20.04044	3.82E-42
X Variable 1	0.000826704	0.046384702	0.017823	0.985807

**Fig T11** Graph shows lack of relationship between tone and number of cited sources. Trend line is present but corresponds directly with the 1.5 gridline on the y-axis.

Although number of sources and number of axes of inquiry do not correspond it might be expected that they show a similar relationship to tone. The general pattern emerging here in the Guardian's coverage is that the more breadth a story has the more likely it is to be negative in tone. Figures G10 & G11 both indicate this, however figure G8 indicates that tone is not directly associated with length although number of cited sources and number of axes of inquiry are.

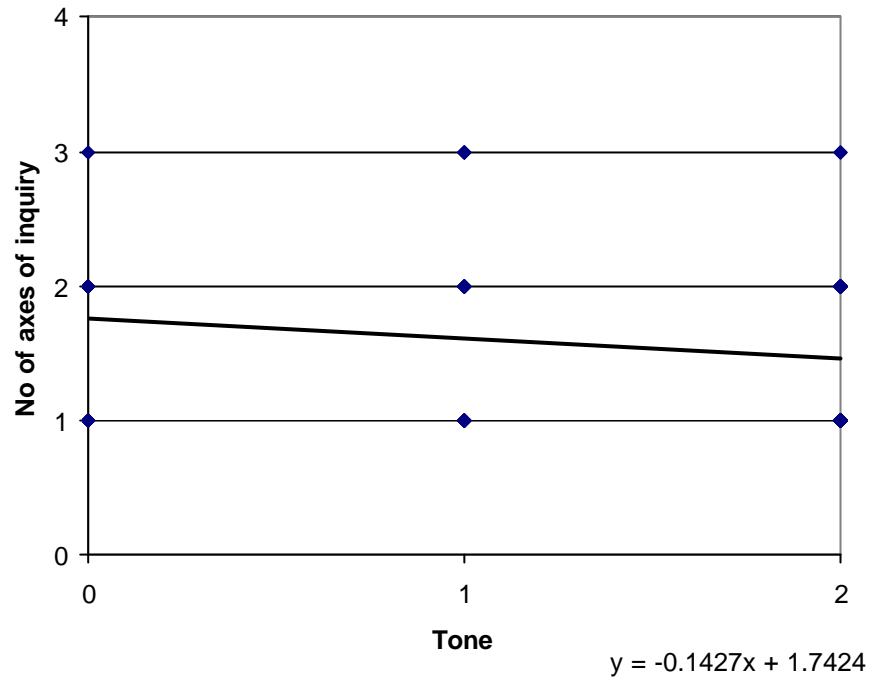


	<i>Standard</i>			
	<i>Coefficients</i>	<i>Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	1.832463817	0.086435136	21.20045	8.19101E-51
X Variable 1	-0.123779872	0.062688512	-1.97452	0.049851815

**Fig G12** Graph shows relationship between tone and number of axes of inquiry, table shows relevant p-values.

In the Telegraph analysis of tone against number of axes of inquiry it can be seen that like the results for tone against number of sources no equivalent of the relationship seen in the Guardian's data set can be discerned in the Telegraph's. The p-value generated from regression analysis shows that there is no significant correlation between the two factors.

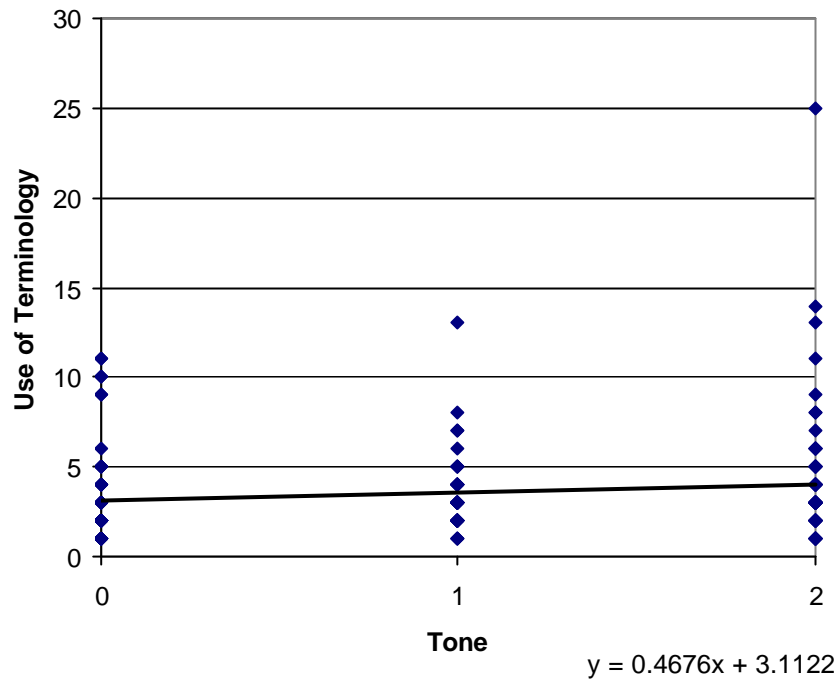
Tone vs. No of axes of inquiry



	<i>Standard</i>			
	<i>Coefficients</i>	<i>Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	1.742393092	0.119244192	14.61197	1.63E-29
X Variable 1	-0.142680921	0.073910316	-1.93046	0.055662

**Fig T12** Graph shows relationship between tone and number of axes of inquiry, table shows relevant p-values.

Tone vs. Use of Terminology

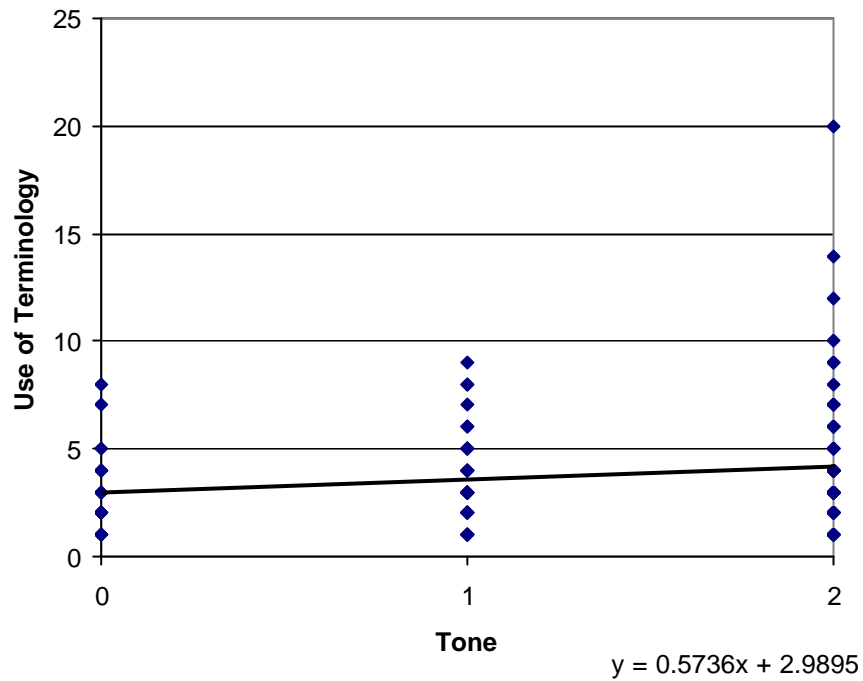


	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	3.11216762	0.349952768	8.893108	6.17252E-16
X Variable 1	0.467603501	0.253809035	1.842344	0.067069931

**Fig G13** Graph shows relationship between tone and use of terminology, table shows the relevant p-value.

This result gives some indication that depth of description and use of terminology show no significant relationship to tone. This refutes one of my a priori expectations that terminology might determine tone with more densely terminological pieces creating a more positive tone. The p-value for both data sets rejects this hypothesis. It is interesting that both data sets show a similar lack of relationship here, perhaps this is the point at which my emerging model of coverage breaks down for the Guardian. I feel though that it is just as likely that this represents the use of terminology by journalists for complex reasons, rather than simply to create an environment of acceptance through which to deliver information on genetics.

Tone vs Use of Terminology



	<i>Standard</i>			
	<i>Coefficients</i>	<i>Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.989514803	0.520825099	5.739959	6.04E-08
X Variable 1	0.573601974	0.322819476	1.776851	0.077862

**Fig T13** Graph shows relationship between tone and use of terminology, table shows the relevant p-value.



### **3.5 Analysis of axes of inquiry**

2001/2002

Scientific	Ideological	Financial	Media	Ethnic	no of axes av.
77%	58%	23%	1%	10%	1.70

2001:

Scientific	Ideological	Financial	Media	Ethnic	no of axes av.
84%	58%	19%	1%	13%	1.73

2002:

Scientific	Ideological	Financial	Media	Ethnic	no of axes av.
70%	58%	26%	1%	8%	1.66

**Fig G14** Percentage of stories which referred to each axis of inquiry and mean number of axes described in all stories, data is shown in total and over both years.

The data generated here comments on the breadth of analysis present in total coverage. It is worth noting that the definition of a scientific axis of inquiry is not a redundant category. Although nearly all articles are expected to make some description of the science not all articles will analyze the science described through a scientific frame of reference. Therefore scores of less than 100% in the scientific axis category indicate that although most stories analyze the inaccuracies or benefits of a certain scientific technique or phenomena, not all articles do. It is also obvious from this data set that the media very rarely analyses science in terms of its interaction with the media. This indicates a lack of self-reference in analysis. It is also worth noting that the percentage of stories using two or more axes of inquiry (the two most common being the scientific and the ideological) is considerably less than the number of stories using one axis of inquiry, this is shown by the average number of axes broached sore in the far right column of the table.

2001/2002:

Scientific	Ideological	Financial	Media	Ethnic	No. of axes av.
90%	45%	8%	0.70%	11%	1.54

2002:

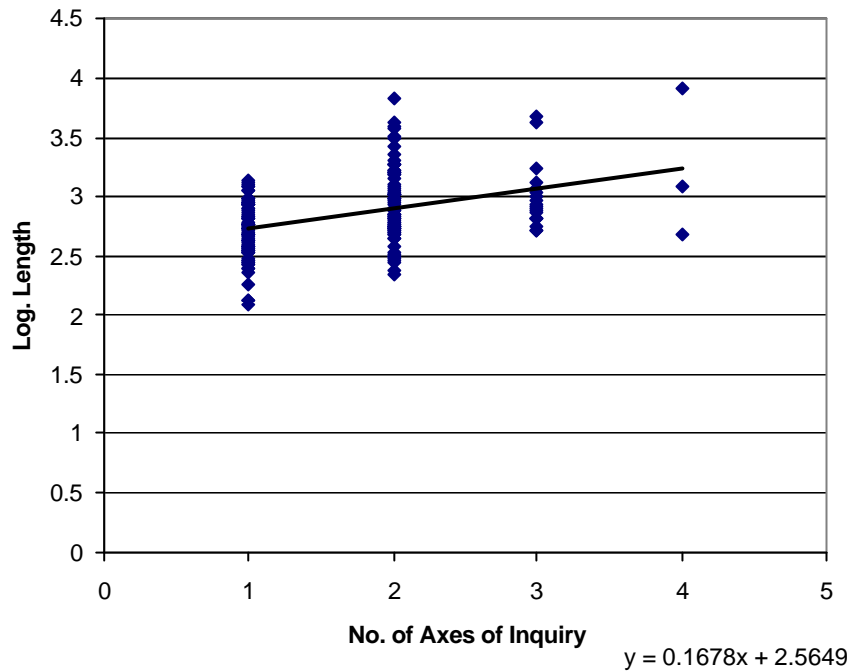
Scientific	Ideological	Financial	Media	Ethnic	No of axes av.
87%	48%	8%	0%	7%	1.49

2001:

Scientific	Ideological	Financial	Media	Ethnic	No. of axes av.
92%	43%	8%	1%	15%	1.57

**Fig T14** Percentage of stories which referred to each axis of inquiry and mean number of axis described in all stories, in total and by year.

**No. of axes of inquiry vs length**

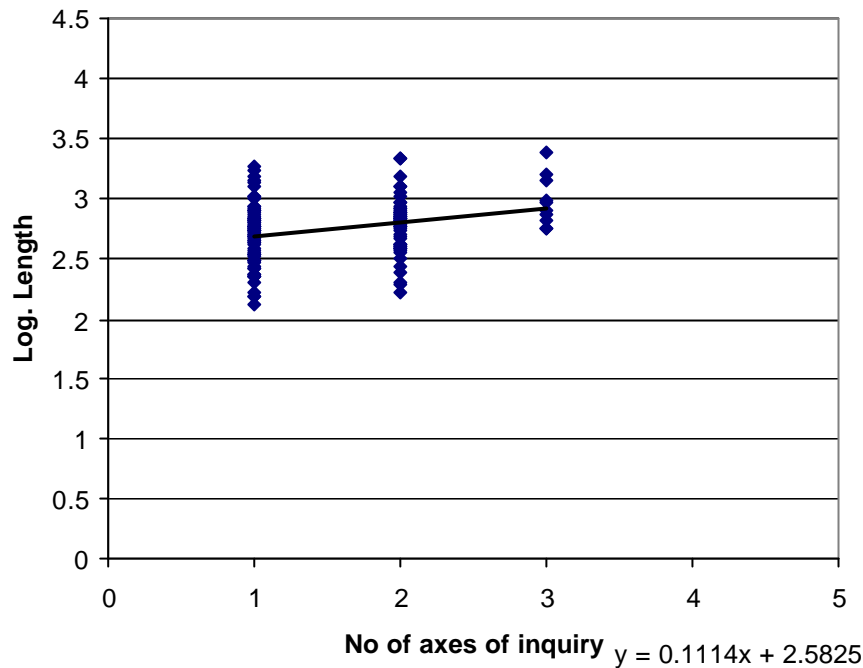


	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.564944586	0.053192327	48.2202	7.3894E-105
X Variable 1	0.167843896	0.028842929	5.819239	2.65609E-08

**Fig G15** Graph shows relationship between length and number of axes of inquiry, table shows relevant p-value scores

The figures above and below show that length (which has been subjected to a log transform here for the same reasons as given above) correlates to the number of axes of inquiry used in articles published by both newspapers. The p-value given shows us that this relationship is significant however it does not show that this is a relationship of causation. More axes of inquiry covered would create a need for a larger story to contain them, however longer stories do not necessarily cover more dimensions.

No of axes of inquiry vs. Length

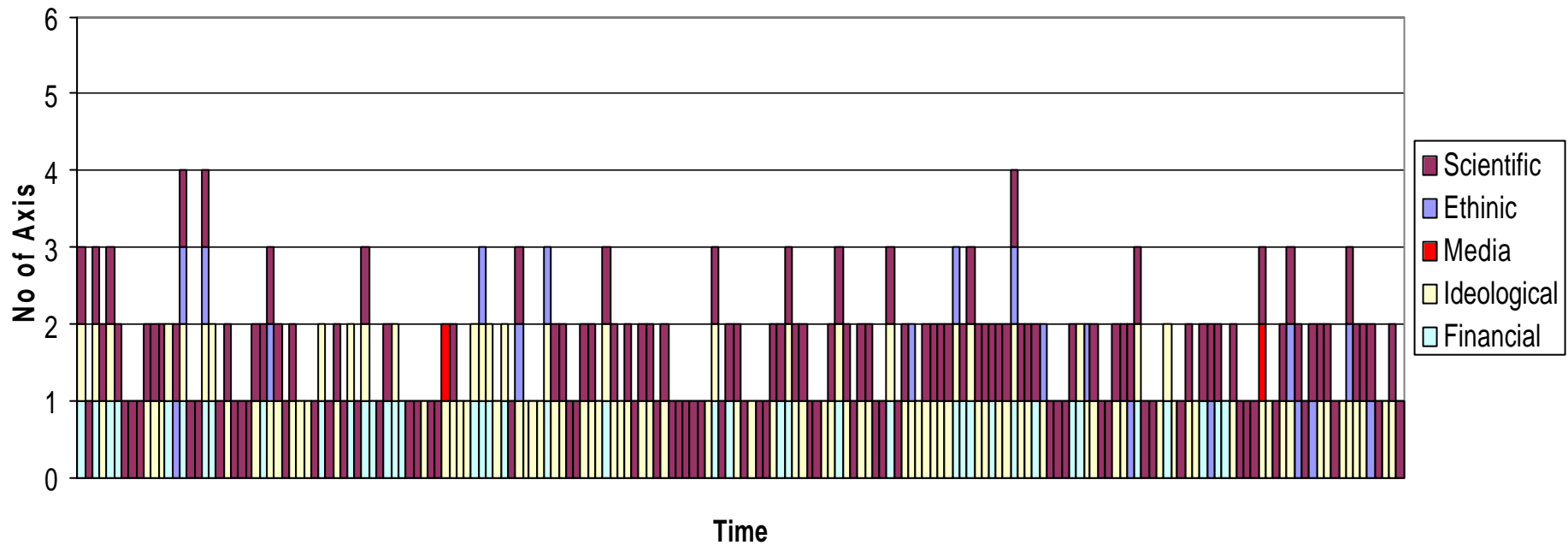


	<i>Standard</i>			
	<i>Coefficients</i>	<i>Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.582478639	0.054999217	46.95483	4.41E-85
X Variable 1	0.111388134	0.033121525	3.363013	0.001005

**Fig T15** Graph shows relationship between length and number of axis of inquiry, table shows relevant p-value scores

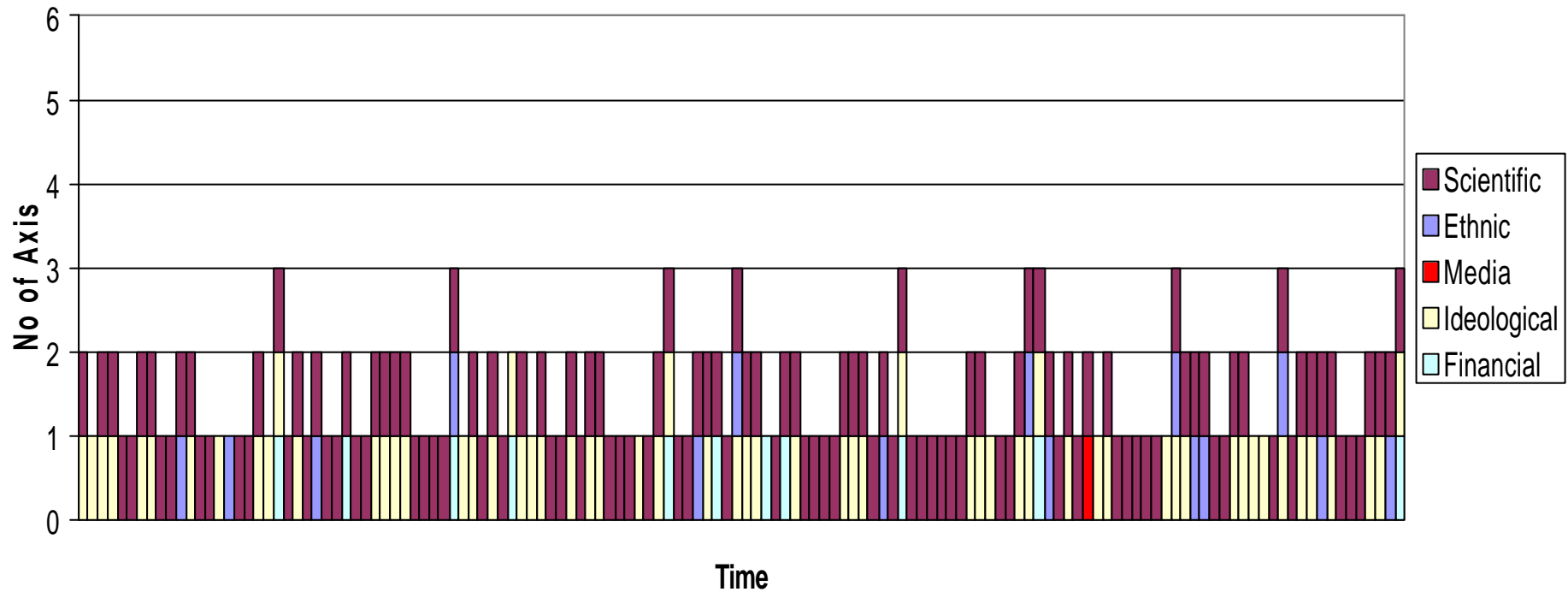
The next two bar charts (figures G16 & T16) show the way in which different dimensions have been explored in stories in concerto. The predominance of scientific analysis can be seen by the large amount of burgundy throughout the graph. There is also a consistent amount of yellow and green indicating that although less represented, financial and ideological concerns relating to GM have been explored. The ethnic dimensions to GM have received barely a smattering of discussion, and the media influences on and from GM have only appeared once or twice in total coverage for both papers. The exact percentages of coverage which explored these dimensions can be seen in tables G15 & T15 above. The difference between the sizes of the columns in the figures below is a result of the greater volume of coverage represented in represented in figure G16.

**Graph showing axis of inquiry in each article on each day**



**Fig G16** Breakdown of axis of inquiry used story by story. Each story is described both in terms of initial axis of inquiry and subsequent exploration of the story, therefore stories which extend the furthest up the y-axis show the most depth of coverage. Key shows coding for colours each colour represents one axis of inquiry. Note predominance of scientific and ideological but relative lack of exploration of financial, media and ethnic axis of inquiry. Also that science is not necessarily the first axis of inquiry, in many cases it is even absent from the stories analysis. X axis shows time running across the survey from 2001 to 2002, days on which no relevant articles were published have been omitted.

Graph showing axis of inquiry in each article on each day



**Fig T16** Breakdown of axis of inquiry used story by story. Key shows coding for colours. Note predominance of scientific and ideological but relative lack of exploration of financial, media and ethnic axis of inquiry. X axis shows time running across the survey from 2001 to 2002, days on which no relevant articles were published have been omitted.

## **5.0 Discussion**

The data generated in the media survey points towards various trends in coverage and the statistical analysis may confirm some of these. The interviews reaffirm the models that emerge in places and refute them in others; they also add a texture and depth to the analysis I present here.

In two years of coverage the Telegraph and the Guardian published 318 articles with direct relevance to genetics, biotechnology or genetic therapeutics. This is a little less than one story every other day. Is this enough? My own feelings would be that this is not enough. The average length of this story will be roughly 800 words, similarly I wonder here if this allows for adequate depth of coverage? I don't think it does and neither did any of the interviewees'. Both of these points illustrate well that this data set is firstly relative within itself, but also relative to the analyser. As a result it throws up more questions than it answers; I hope though that this at least sheds a little more light on an area critical to us all.

Both newspapers published articles in an essentially random fashion in relation to the events they portray that is there was not a statistically significant clumping of articles around certain dates. If coverage followed the events exactly articles would be seen to clump around significant dates, especially as more than one article maybe published on any particularly significant day. When the data was analysed with a 'runs' test, it was shown that this clumping was not occurring. The distribution of articles is not significantly different from random. This infers that while subject to some time and space constraints in terms of publishing, science journalists often have a greater choice over which stories to write and when. This would imply that time and space constraints only exist on the day of publishing, after an article has been nominated for investigation. To some extent this justifies my proposition in the introduction that restrictions on coverage of genetics are not in the main derived from time and space constraints. Some of the interview data supports this, to quote Tim Radford, "In the sense that we could publish a story tomorrow I suppose [these constraints aren't so pressing] but I think you'll find very few people here think in those terms, as I said before its today's deadline for tomorrow's issue that matters". Roger Highfield contends that time is the rate limiting factor in his coverage and that space

and context are the deciding factors on the night as to whether a story will be included. It is here that a sharp division can be seen between the criteria for choice of story and criteria for publishing in a given edition. Both science editors said that the limiting criterion in deciding which stories to investigate was perceived public interest. “What interests my 2.5 million readers,” as Roger Highfield puts it or as Tim Radford states, “There's no point in a newspaper story unless it's read”. After the generation of the story, three more factors come into play in deciding whether it will be published on that day; these are time, space and context of the day. Tim Radford describes the pressures of context, “On a day in which the Berlin wall has been pulled down, a small advance in genetics doesn't matter a bugger”. This essentially fits with my statistical analysis of the distribution of coverage over time. The constraints described here are independent of the actual event which generates the news story; therefore they act against each other, this results in the independence of distribution of news stories from the events which they portray. Effectively the pressure to publish news on the day it occurs is not as great as the perceived interest of the public, the other events occurring on that day and the space available to tell this story in.

Between the two newspapers the Guardian had far higher output, publishing nearly twice as many words as the Telegraph. The Guardian also used more sources, more metaphors, and explored more dimensions in each article than the Telegraph. But the Telegraph was consistently more positive and in doing so used marginally more terminology. This is very much what I would expect and the same view is echoed in the interviews. Unless you come to this data with a specific idea of how coverage should be undertaken this does not imply that coverage is better in either newspaper. Rather than making this implication I hope this data forces a consideration of what does constitute good coverage.

In the analysis of story content it was shown that in both newspapers coverage showed a significant relationship between both number of sources used and number of dimensions explored within a story and the length of that story. The correlation seen here was expected and fits with a reasonable a priori assumption that longer stories will show more depth of coverage, describing the views of more commentators and analysing the story from more angles. The relationship between story type and length is related to this result in as much as different story types seem to roughly correlate to different story lengths. The analysis of story type shows that there are discernable categories of story and that these



categories show distinct patterns of coverage. News articles are on average the shortest story type with background and opinion being similar in length in both papers. The standard deviation from average length in these categories indicates their uniformity. It can also be seen that story type has some relationship to number of sources used and presumably number of dimensions explored (unfortunately this was not one of the aspects of coverage analysed) this would support a connection between length and depth of coverage. It might also support a connection between length and other aspects of story type i.e. number of sources used. This also shows that those factors ultimately responsible for length such as space limits or editorial imposition may also be responsible for shaping the type of coverage.

The use of sources between the two newspapers is different in general terms but similar with regards to different story types, both papers use more sources with background and news articles but consistently less than one source on average for opinion pieces. This could indicate that while the papers are reporting on events a desire to corroborate the information is present. When it comes to asserting opinion however both papers seem happy to assert that of the individual with very little support. Perhaps this is why the interviews indicated a feeling on the scientists' part that there was a lack of balance in the stance various media take in their response to science. This also implicates story type as an influence along with length, on content.

The Telegraph's use of scientific wording is only marginally greater than that of the Guardian. There is however an interesting decline in use of terminology from 2001 to 2002. This could be a result of the HGP's announced completion at the beginning of 2001. Comparing this to the other event to receive heavy attention in the time of the survey, the Realian cloning claim at Christmas, it seems that the obtuse nature of the first event might have demanded a greater use terminology. The consequences of the cloning event seem more obvious and so might be explained in more ordinary terms. Which ever is true there is a possibility here that events influence their own coverage in more significant ways than might be expected. Using these two events as reference points is likely to be a fruitful avenue of analysis however the discussion earlier indicates that these stories have not had a significant effect on the distribution of news coverage. This does not mean that they have not had their part in shaping coverage. With this point of reference I would also like to explore the contrast between the HGP and the Realians as news events.

The radical difference in the tone of reportage of the two events may also have affected the averages taken from my raw data. As events they also provide a striking example of the way in which the press may be manipulated. The description given earlier of the manner in which articles are selected for publishing indicates just why the assimilation of the Realian story into the press was so complete. At Christmas time there was very little else happening. Before taking this analysis too far though it is worth remembering that these were also isolated events which did not receive the same coverage as much of the rest of the genetics that occurred in the intervening period.

To return to the use of terminology it is interesting that the average amount of words used is around three or four. This does not seem a huge amount considering nearly every article used DNA and gene as terms, DNA was one of the archive search terms. This would mean that after these two words had been used there were only roughly two more used to describe the specifics of the story. This does not seem like a huge amount. In fact it means that Berube's complaints about use of terminology seem unlikely to apply to the press. Do they still apply to scientists? I think the answer to this is linked to complaints about inaccuracy from scientists. Both David Cove and Alan Handyside identified inaccuracy as one of the major faults with current reportage. It appears that there is an equilibrium to be balanced here, if scientists use too many terminologies they become exclusive but if the press use too few they become inaccurate, assuming that is that use of more terminology would increase accuracy. That assumption can be made with two provisos, one that they are used correctly, which I agree with Alan Handyside should be a "trivial" issue and two that you accept that oversimplification causes inaccuracy.

The analysis of metaphor that I have presented here maybe quite interesting but it is unfortunately, far from complete. It quickly became obvious that to obtain a satisfactory explanation of the way in which metaphors are working in the press serious semantic analysis would be needed. A few interesting trends may be discerned though, firstly metaphors are not used as often as it might be perceived, secondly that there are some metaphors which recur in and between papers and thirdly that those articles which use metaphors are more likely to use two than the general coverage is likely to use any. The metaphors used are all familiar too. Frankenstein and designer babies both get a look in. Worryingly the most popular metaphors by far are the most overtly deterministic. 'Blueprint', 'book of life' and 'playing god' led with 'death' or

'Methuselah' genes following closely. Even though Tim Radford specifically questions this type of determinism when he states, "I really distrust the idea of the behaviour genes ... I don't think behaviour is simply genetic at the crude level people would like it to be at," the attitude still seems to be present in both papers' coverage. The issue here is undoubtedly linked to the prior discussion about simplification. The determinist nature of the presses' conception of genetics might be a result of their desire for certainty. As David Cove described one radio interviewer, the general press also may not be, "Prepared to accept it [is] not a simple question to answer."

When the analysis of tone was incorporated into this model the conclusions inferred become even more anomalous. Firstly it can be seen that there has been a change in tone over the two years in the Guardian from positive to more neutral. The Telegraph seems to have remained more consistently positive over both years. It can be seen that there is no significant correlation between tone and length for the Guardian data set, but there is a significant negative correlation in the Telegraph data set. The more positive the tone of the article the shorter it is likely to be. This might imply that the more positive a story is about genetics the less likely it is to justify itself. I would prefer to think though that it represents the more positive average tone of shorter news type articles. Given that there is a possible relationship between depth of analysis and length emerging in the Guardian and Telegraph data sets it might be reasonable to expect that a similar relationship exists between depth and breadth of coverage and tone. In the first case this may seem unlikely in the Guardian data set, where tone and length are not significantly linked but more likely in the Telegraph's coverage where they are. To check the significance of linking tone and length in this way, in the Telegraph's coverage at least, tone in different article types was examined in both papers over both years. Interestingly a link between tone and story type did seem to be evident here. In both papers and in all but one year for one paper, opinion type stories are more negative in tone than background or news pieces.

When the datasets were then analysed to see how the factors influencing depth and breadth of analysis affected tone the results were quite surprising. It might be expected that having discerned a link between depth and breadth of analysis and length and another between length and tone in the Telegraph's coverage we might see a relationship directly linking depth, breadth and tone. Conversely having not made the link

between tone and length in the Guardians dataset we would expect not to find such a pattern. In practice exactly the opposite is true. While the Guardian data set shows a significant correlation between tone, use of sources and number of axis of inquiry the Telegraph does not show either. Neither paper's coverage shows a meaningful relationship between tone and use of terminology. This was particularly surprising as the Telegraph, which was consistently more positive in tone used less sources and less axis of inquiry but more terminology.

The logical conclusion to draw from this is that although tone and breadth/depth of coverage may interact in some cases there is another overriding factor in play here. My suspicion here is that the editorial and personal ideological stances present are the overriding factors. To a great extent the interviews agree with me. One quote from Tim Radford highlighted this in particular. "We are much more aware than say the Daily Telegraph of how authority uses technology, how people are controlled and how people are abused and hurt. There would be as keen a folk memory here as anywhere of the peculiar horrors of eugenics, which were genetics the last time round."

When analysing breadth of coverage through a description of the number of dimensions a story broached the pattern that emerges reaffirms the differences between the Guardian and the Telegraph. The Guardian used each of the identified axes of inquiry more frequently and surprisingly used the financial perspective more frequently than the Telegraph.

How then does this model and the information gathered in the interviews compare with those problems identified in the introduction? Well firstly the problems of science communication are different for either side of the process. Scientists are unhappy with inaccuracy and journalists are unhappy with scientists' semantics. This fits with my analysis of terminology and what I would describe as its restricted use. Similarly the interviews indicate that the unwillingness of the press to use provisos creates problems. Although both Alan Handyside and Tim Radford indicated that the press was prompted in its selection of stories, this does not seem to have affected the distribution or tone of stories at the most gross level. This is probably because other factors have a greater influence. Time constraints are one area which does seem to create equal problems for both groups, however as I have demonstrated these may be less restrictive of the press than is claimed.

There was some confusion both in the interviews and the survey as to what the presses' role should be in coverage. On one extreme Tim Radford states, "By making heroes of scientists and making demons of them we have our part to play", while this highlights the presses influence on scientists it diminishes the democratic function posited by David Cove, "The benefits [of press coverage] clearly are to have a well-informed society." The division of articles into type shows that a range of functions are performed discretely by different story types. Temporal analysis demonstrated that the main coverage did not simply follow the news. The division between interviewees demonstrates the confusion in this area well. Both scientists were firmly of the belief that the press should foster democratic debate; David Cove however recognised the commercial motivations to sell newspapers. Both journalists initially stated their objective in writing as being read, and so presumably bought, though Tim Radford widened the presses remit to include education and the protection of debate. One of the recurrent themes that came from the Royal Societies' 'Speaking Out' forum was that accuracy of information is central to the public in its assessment of GM.<sup>(34)</sup> This then should fit with the more egalitarian views of the two scientists; unfortunately this argument spills over into a much boarder discussion of consumer politics. It is obvious though that the demand to entertain the perceived public interest and the need to inform the public remain while not mutually exclusive very difficult to reconcile.

Mistrust does not seem to be a huge problem; apparently the press has a good sense for "bullshit" and effectively eliminates the more spurious research as Tim Radford claims. Those scientists that remain are generally trusted and indeed collected into a "portfolio of contacts," as Alan Handyside explained. From the other direction scientists seem more keenly aware of the manner in which they may be distorted but similarly cultivate journalist contacts. This also implies that contact is not a problem.

Narrowness of coverage does however seem to be a problem and one which the scientists interviewed seemed more aware of than the journalists. The data analysis given also indicates that some areas of interest are given more consideration than others. The corroboration of interviews and my data points towards the need to widen and deepen the area of coverage and the context in which analysis is created. To a certain extent the interviews with scientists justify my method of analysis here. Both have observed the same narrowness of coverage and both

point towards a broadening of scope, both in terms of selection of content and the presentation of that content. David Cove said, “I think the role of newspapers is to take it further than reporting the science. They can certainly have opinions - balanced opinions on the use of science.”

Balance would I suggest be obtained by serious consideration of the dimensions of science identified in my method. Alan Handyside echoes this when he says, “I'd like to see journalists actually using their talents to explore the ramifications based on an accurate knowledge.”

The survey and interviews have both thrown up numerous further questions. The surveys limitedness in analysing metaphor is apparent, but there are still other analyses that could be undertaken on the data set provided here which time constraints have not allowed for. The raw data from the media survey has been included in this presentation in digital form in the hope that it may be useful for further such inquiries. Analysis of authorship showing specialist correspondent verses news desk output might be interesting and reveal another influence on the aspects of differing story types. A further analysis of use of terminology in varying story type might also have been insightful in this area. The interviews also threw up several interesting questions for further consideration. Is genetics coverage significantly different from that of any other area of science? How has tone of coverage changed over a far longer time period? How is risk assessment presented in coverage? How do the mechanics of generating a story function?

With reference to my original work plan this project has failed to achieve the full scope of that brief. I feel though that this was due more to over ambition than underachievement as the size of this report indicates.

There were various improvements that might have been made to the analysis and interviews. A quantification of the tone of the sources used should definitely have been undertaken. Equally a quantification of the tone created by articles which explored different dimensions to stories might have provided further description of coverage. There also seemed to be a great deal of overlap between stories published in Nature and Science and stories published in both newspapers, this might suggest that the coverage of more specialist journals influences the output these papers. Further interviews with a broader range of interviewees might also have been more revealing.

That is not to say that the method of analysis that I have applied here has not been instructive. I stand by the categorisation of articles I have created and the analysis based on this. The analysis of dimensions covered by stories has been particularly informative and is justified in part by the interviews as I have shown above. The other analyses that I have made distinguish between the coverage of the two newspapers. This answers one of my initial questions, there are two different models of coverage present here and I hope I have gone some way towards describing the features of each. I think that the analysis of tone has been successful on a gross scale in that my valuation of the tone of each paper corresponds to the stated stances of each title identified in the interviews. Although the two subsets of data show differing patterns of relationship between tone and story length and content the confusing disparity between results points to the influence of other factors. The tone of the article it seems is largely defined by the newspaper and the reporter's pre-existing attitude. The content of the story is largely defined by assumptions as to what the reader might find interesting and the format of the story is largely defined by its length, which in turn is defined by available space. Space limits we find can be determined by reference to other news stories occurring that day and the stories own inherent news value or perceived public interest. It occurs to me here that if perceived public interest were not the limiting factor here coverage might take a very different shape.

The conceptual framework I have used is also I believe justified. The need for critique that is demanded by Ross can be seen in the universal unhappiness of the interviewees with the current state of coverage and the lack of exploration of the more humanitarian ramifications of GM. The factors identified by Hall have all been seen to be in operation here and hopefully assigned some kind of relative value. Technical infrastructure's effect can be seen in editorial policies, relations of production can be seen in the pampering of the press to perceived public interest and fame-works of knowledge have been implicated in the use of terminology. The identification of the influence of these factors also reaffirms Nelkin's work as I have used it. Berube's work is touched upon but neither confirmed nor disputed with relevance to scientists.

Appadurais' framework is justified at the same time as my use of it is, above. I believe this is the key to the improvements that might be made in the press coverage of genetics. The widening of the public debate in this area will only occur when a corresponding widening of

analysis is seen in wide stream press coverage. I agree here with Alan Handyside when he says, “What I'd like to see is writers using their powers to put across the science but also actually informing the debate about the nature of the information we're getting through from the genomics revolution.” By understanding the relations between these imagined worlds of media and science and their relation to the other imagined worlds constituting society and identified through Appadurai we may be able to effectively shape our world as we should. In much the same way that in-vitro studies and single gene analysis are soon to be abandoned – genomics superseding genetics, it is not enough to dissect science or media alone or even together. Real understanding of these issues in science and the media can only be gleaned by understanding the dynamics of all these imagined worlds and their interplay together.

To quote one of the characters in Terry Gilliam's *Brazil*, “Our job is to make the connections and reveal them,” this is indeed the job that faces society at present. Connecting science back to society is crucial if it is to become truly democratized. I believe that the media, through the use of the same system of analysis employed here, is the best vehicle we have with which to achieve this.



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## **Appendix 1**

### **Interview with Prof. Alan Handyside 7/3/03**

Questions specific to Observer article in which you are quoted:

*How did Robin Mackie choose you to interview?*

I'm associated with a fertility clinic in London which is associated with a public relations firm, we're putting out a lot of press releases so in general terms people are aware that I'm prepared to talk to the press. I make myself available. I think it's also done by word of mouth, reporting these things is a question of contacts, specialist reporters actually build up a portfolio. Lois Rogers from the Sunday Times rings whenever there is this sort of story to get an angle on it, even if she's not actually going to quote me. I probably have contacts with about half a dozen journalists. I think in relation to this [story] Prof. Richard Gardener who is quoted extensively, was my first supervisor. He probably recommended in this case that they talk to me as an independent commentator with experience in the field.

*Do you feel that the story is accurate, generally, and scientifically?*

It's an approximation, it's a compromise and this is a very difficult area as it's not fully understood. It was obviously featured in Nature and as such was a news item, there was thought to be some new evidence but the facts were not conclusive. So the difficulty is in striking a balance, this is actually quite a good example of a situation in which it wasn't black and white. I can't say there's no risk and there's no evidence that there was

a risk. How do you handle that? I had to give the journalist a background briefing, they'll often pass the text by me so I can get a chance to correct any factual errors and can subtly change the way they write it up. Journalists obviously have a talent for making a good story and I have to tone it down quite often. So the issue was; we have treated patients previously and on the basis of this evidence I don't think it was worth worrying them that there are going to be unforeseen defects in their children. So there's a real responsibility here, it's not theoretical. These experiments throw up theoretical considerations which we must take into account but in a news feature like this you have to be careful not to worry existing patients. Obviously I'm concerned that patients that could benefit are not put off for spurious reasons. I cannot actually say that there's no risk because we're still in the process of evaluating. So it's quite a tricky one. I think in the end it was a reasonable balance, if it had been too balanced it wouldn't have been a story.

*How would you judge the tone of the piece?*

I don't think it's bad, it creates interest in the area and it's reasonably informative. They're interested in this area because of its human interest.

*Is that an appropriate tone?*

I don't think I had a problem with it. It is based on a genuine discussion scientists were having in the area about whether or not there is some degree of predetermination in the embryo and what consequences that might have for assisted reproduction, so to report that is fair I think.

*Do you think the article covered all of the relevant dimensions to the story given the length?*

I think they've gone about as far as they can go.

***Would you say it seems to be a reasonably clear and understandable piece?***

It's difficult to tell, there's not much background on the actual technique, so the readership is expected to know, roughly speaking what pre-implantation diagnosis is about. Without prior knowledge of course the superficial view might be that we're interfering with the early stages of human development and that there are possible fears that we're not taking into account and that therefore we should stop doing it. I think that would be the wrong conclusion to draw but how you would deal with this in a limited space I don't know. I think it would be helpful to have diagrams in the piece but then that takes you over to a feature length story and you may not have space. I don't really know that this would be understood. I think even the students find this difficult to understand

General questions on media coverage

***Do you feel happy with the media coverage of genetics?***

Generally, no I find it very frustrating there is a lot of inaccuracy, particularly on television. The problem is that if some one with no science background is leading the discussion then only leaving 30 seconds in which to respond then it's actually very difficult to counteract the errors that are put across in the questions. There's wide spread ignorance, people really don't know. I find myself having to coach journalists on various aspects of genetics, they just don't understand what they have to report on and they admit it, they know it. They'll say to me, "Can I pass a story by you?" and I'll have to correct it. So in general terms there are a lot of silly inaccuracies that give people the wrong impression. Its superficial, people are worried about going into it in any depth, otherwise they'll lose their reach.

*Would you feel that the tone of present coverage was pro or anti genetics?*

I think journalists fail to pick up what the benefits might be, it's easier for them to grasp what the dangers might be. Reporters have a better nose for miss-uses of science than the positive side; it's just in the nature of journalism. So I find that they're simply more aware of that side of things and less able to put across the potential benefits. This is difficult because they are largely in the future. Clearly the vast majority of the scientific community believe that the sequencing of the genome will lead to a revolution however if you ask them how has it impacted today on current medical practice, it's actually negligible. So we're in a very difficult situation and yet a lot of money from science projects is going into these areas so it's a very interesting situation.

*How do you view the role of the press in relation to genetics, ideally and in reality?*

I really wish that some one who was qualified in genetics would make the time and effort to get into journalism and to put the message across. Steven Rose is an example and Richard Dawkins is also very much involved in the public understanding of science. But I think we need science reporters who are qualified in genetics so they can accurately get across the principles of genetics and then bring to the public's attention the real issues. My frustration is that the current crop of journalists gets the sense of the controversy and so on but then is not able to deliver on it. I would like to see just more accurate reporting and more discussion of the real issues.

*Do you feel apprehensive about press coverage yourself?*



Having worked with Robert Winston at Hammersmith I did nothing but press coverage for two years. I'm not very good at that; he's much more talented. What I do fear is a live broadcast those are very intimidating and very difficult. As a scientist it's very difficult to come up with a one line reply to the question, "Are you playing god?" Which is what you have to do in a 30 second interview. A lot of television in this country is marred by the fact that you have literally two-minute time slots. I find it amazing that so many people are willing to go on the Today programme when they know that you can be waiting for an hour hanging on a phone line and your literally only on for 30 seconds, say a couple of sentences and that's it. This isn't the case on the continent, they will spend an hour discussing it, they have programmes that go on interminably, it's quite the opposite. That gives you the opportunity to get your point across to try and get some balance and try and get some accurate facts across. So I would tend to shy away from interviews of [the former] kind they really don't give scope. I also then always go over the questions that the interviewer wants to cover and explain to them that unless they feed me the right questions they won't get sensible responses. They're in the position that they are leading the interview and unless they lead you correctly you can't give sensible replies; you just end up in a cul-de-sac. Of course I've been through media training and one of the ways you can handle this is just to ignore the question. You decide ahead of the interview what information you're going to get across, you have thirty seconds to do that and you hear politicians do this every morning. You can see how that moulds media coverage and that's how we're trained to deal with it. So is it any wonder you get a mixed bag?

I think I do perceive the Internet is enabling the media to extend coverage, which I see as a very positive thing. I give all credit to the BBC for putting in the investment and getting there first.

*What do you feel are the benefits for Genetics of press coverage?*

I talk to the press to make sure that the public is aware that you can do various things. We can help couples that are at risk of genetic disease through assisted reproduction. Its very difficult, how do you advertise clinical services? Doing it through a third party you may not get a balance of coverage but it does raise awareness and there is an opportunity to see the opposite view. I very much put my faith in the patients themselves. I have a very liberal point of view from that perspective and I'm very wary of government regulation. I'm more wary of that than depending on the common sense of ordinary people. There will always be a few people who want to do extreme things, the lesbian couple who both have inherited deafness and want a deaf child. But to me sacrificing on the margins is worth while to maintain our basic liberties I think as soon as the state starts to intervene and draw out rules and regulations then there are dangers. So vox-pop is the way of getting across the thing.

*What do you feel the benefits of media surveys could be to scientists?*

I think it's very important because people with professional qualifications in genetics need to feed back to the media, it's an important link and we need to guide them in many ways. I certainly know that on a one to one basis many reporters are aware of their lack of knowledge and actually want to do balanced coverage. We've got a huge task ahead of us. I went to the first meeting of the Human Genetics Committee and what is clear is that you have to educate the public on how to handle this information. As part of that process the press and the media are a vital element. So you have to measure how effective that is, whether they're getting it right or they're getting it wrong and in what ways and how you can improve it.

*What do you think would be the most interesting axis of inquiry in such a survey?*

It might be interesting to see if genetics is getting more coverage than other areas of science. It would be very interesting to see your analysis and see what the balance is.

I wonder whether we turn people off by repeated stories of breakthrough cures for cancer etc. Actually what's coming through from this interview is that I'm working with a clinic which has a PR consultant. Cancer Research has a big PR department and that's only come in in the last few years with Paul Nurse and so on. It became very noticeable that every time they published a paper it was a breakthrough and there would be a piece in the press. They had to say it was a breakthrough because they had put out a press release. So the mechanics of how stories are generated is another interesting area. Journalists don't just sit about thinking about these things, they get handed bits of paper, even from me and to be perfectly frank we have various motives. One is of course to promote the fact that we are a clinic and we offer certain services. Now we believe in those services but we're also a private clinic so we charge for those services. Whether that brings into play the journalist's instinct for trying to decide who the good guys are I don't know.

An analysis of different lengths and what stories are covered at these different lengths and the tenor of them would be very interesting.

***What do you think are the limiting factors for scientists in their interactions with journalists?***

The process of getting the information across to the journalist is slow and it is this that is the rate-limiting step. So I'm currently thinking of even writing for the papers in frustration, to cut out the middleman. I find myself having to spend time and teach journalists about meiosis or teach them about some quite complex concepts and you have to take what you get. It could be a science graduate and that's fine, though they're not necessarily a geneticist. Hopefully we'll get more of them, some people are already on board with various newspapers. But the process is certainly like that, I mean I could spend a couple of hours doing an interview, we'll have to go through the questions, I'll have to explain why they may not have interesting answers and so on, you do have to invest a lot of time. A two-minute TV slot will take half a day of your time.

Scientists in all spheres are hugely overworked and underpaid which is a shame. I think a lot of us are prepared to talk to the press so that's something on the up side.

*For journalists with scientists?*

They do this for a job whereas for the scientist it as a vocation, really science involves you completely. Now if you contrast that with a journalist, even if he's a specialist journalist he has to write so many words in a period of time then he has to move on to the next piece. He's not committed to this area, he's not committed to getting it right but he has to do a professional job though. So from his point of view I think the constraints are editorial, deadlines, limitations and he has to produce a certain number of pieces, continually moving on. You can't go away for two weeks to study. I'd be interested to find out actually whether any science journalists go into the library to study the background of a particular area, I suspect the answer is they don't. They can only talk and quote a certain number of people, its limiting and they don't have carte blanche. I think it must be very frustrating for them.

*What would you consider to be the ideal story?*

What is disappointing is that talented journalists do not seem in the main capable of getting across the excitement of science, the fundamental stimulation you can get from learning a bit more of the truth. I think they shy away from it they instinctively don't feel comfortable. I mean some of the images that come out of science and some of the mechanisms are really quite awe inspiring, unfortunately awe inspiring is not really what journalism is about. I suppose the closest you could get would be a special issue of Nature. Say on the completion of mouse genome sequence

recently, there were some very interesting features from a broad spectrum of commentators that amounted to something of the flavour of the enormity of this information. I think journalists are shy of doing this.

*What dimensions would it explore?*

I think there is scope to go beyond the science. What I'd like to see is writers using their powers to put across the science but to actually inform the debate about the nature of the information we're getting through from the genomics revolution. This is happening to a certain extent, there are a series of books dealing with this and possibly that's what is required - you have to have that kind of length. I think there are so many interesting areas you could go into and I'm rather disappointed. What I'm getting back from journalists generally is that although they're picking up on the negative aspects they're picking up on those negative aspects not because they're coming from the journalists themselves but they're coming from us, our fears. Whenever you are involved in something there are pros and cons and fears and the journalist latches on to this idea and takes that point of view. I'd like to see journalists actually using their talents to explore the ramifications based on an accurate knowledge. That would be my idea of how to really stimulate it and I don't find myself stimulated by the coverage at present. All I'm getting back are what seem to me tired arguments, I'd like to see new ideas coming in and I think there's scope for that. But they don't seem to have taken up the challenge.

Perhaps this is just early days and that eventually it will mature as an area of journalism and come together as well as getting it right. I mean to me it's trivial to get it right. For example what frustrates me about television is that you see a wonderful graphic, one that we couldn't possibly afford to put together in a university situation for teaching, it could so easily be accurate and it's not. It gives an immediate and high impact visual

impression to a very large audience that is sort of right, with just a little bit of editorial control it could have been accurate. I guess we just have to get in there and work with them more closely, just continue the effort to get it right.

***Do you think that scientists and journalists would benefit from a more methodological approach to reporting?***

I'm sure they would, I think it could be mutually beneficial. We have a PR department in the university but journalists tend to approach me directly, I think we can be much more effective. I think journalists would prefer this, this is the way politics works, through briefings and I think there should similarly be much more activity in terms of press relations. Both within the universities as well as in big charities like Cancer Research who know they have to go out there and keep up the profile in order to keep the money coming in.

***What do you think is the best way to analyse science, for yourself, for the public?***

Any scientist comes from a particular point of view, so we have prejudices. We are taught basically to be sceptical and it's a very pedestrian activity at one level. We're interested in evidence and weighing evidence and you've got the background knowledge. I think for the public this is the problem, there's a lack of trust in scientists. They do actually think there's something in the fact that I'm trying to create Frankenstein's monster. I think this is a genuine problem and there's no way round this because there needs to be trust. You have to train for three years in your first degree then three years in your PhD to evaluate evidence in a particular area. The public cannot bring that background so they depend on scientists to evaluate this correctly, to filter this information. If that trust isn't there then I don't know. Certainly you can't necessarily trust journalists for all the reasons we've just discussed. Thinking about that, I used to work with Robert Winston, Robert actually has very little background knowledge in science. I used to get very frustrated because he used to do interviews and in the course of the interview he would

mention various [procedural] facts and they'd all be incorrect but they were things that didn't really matter because he was getting the basic principals across. If I went home and spoke to an elderly relative they'd say, "Oh how wonderful he was," because he came across as avuncular, trustworthy. That's his power and he's in a very responsible position.

That's the way it works - if any of us look shifty on the box, people won't trust us. I guess from amongst us the best way of doing this is having people who will commit themselves to acting as intermediaries for the public, who the public will trust. The difficulty with this road is that I for example completely disagree with Robert about a whole series of things and feel that he has a lot of power because of the public's trust in him.

## Appendix 2

### Interview with Tim Radford, Science editor, The Guardian 5/4/03

#### *What are your criteria for choosing which stories to report?*

Well there are always two problems. One is, is the story any good in the first place and the second is what else is going on. On a day in which the Berlin wall has been pulled down, a small advance in genetics doesn't matter a bugger. On the other hand on a day when there is nothing going on and someone pops up and says, "I've discovered a gene for violence," we react. We might react with caution but we will report it, even though I look into my heart and I know the scientist hasn't found a gene for violence. I don't have a training in science but I do have a training in avoiding bullshit. You don't have to be that clever to spot where it is coming from. So you have two things going on in your head, what is it and how does it measure against the day.

That said there are several ways in which news turns up. It turns up partly because there is a science agenda of news management. The most obvious example of this is a publication in Science or Nature which we hear about under embargo. We'll report on it the same day as they publish. Quite often there's a press conference or release associated with it which guarantees that it will focus our minds. I don't have any problem with that at all. A bit of advance warning's very helpful because a lot of it is often hard to understand. It's particularly helpful to have some one like Jon Sulston available for interview. The other thing which generates stories is the horrified reaction, that is, "Oh my god they've cloned a sheep, whatever next, are scientists playing god?" Or they've cloned a baby as in the appalling alleged Realians at Christmas time. I



didn't report on it and I think I would have told our news desk to have nothing to do with it but that's no good at Christmas. Newspapers do tend to react to weak stories when there are no strong stories around. You're either managed by the community or you react to what is out there or you go and find it for yourself.

In the case of actual discovery the problem is that most of the time scientists would rather get the anointment of peer review out of the way first, before they talk to you. If you hear these things you're likely to hear them at conferences and their likely to come wrapped up with provisos or pressure not to carry anything at all until it has been peer reviewed. I can see the logic of that. But as a species the media is not convinced that they need to listen to inglenfinger rules and peer review. In the first place we know that huge quantities of error and folly get passed and then get denounced weeks or indeed days later by other scientists. So peer review itself doesn't mean something's right or even very respectable. The second thing is that if you hear that somebody's transplanting heads, in a wild case, why would you wait until everyone else has it? If you found out by legitimate means - that is you're not breaking embargo - why not just run with it, it's a good story and what the hell are you here for? This is the crash barrier which the media and science keep running into each other at. Scientists want a result, in fact they want the truth but they often settle for a result that looks like truth. What we want is a story. Although the process of research in both cases is practically identical the difference, of course, is that it doesn't really matter if anyone reads your scientific paper, its there to establish something - that you're the first, that you've eliminated this one or at least that you've demonstrated that you've spent your grant money. There's no point in a newspaper story unless it's read. So we have this other imperative, we're not just looking for news about science we're looking for stories that people will read, so the criteria are not the same. We love wacky science, the fact that it's not true wouldn't stop us reporting on it because it was huge fun. I justify it by the fact that people read it and remember it even if it's not real science. Everyone reads short funny stories.

Are there some short funny genetics stories? Well there are certainly some that appeal. All the cancer gene stories cause a reaction because we're frightened of cancer. Very rare genetic diseases never get reported because no one has ever met any one who has suffered from those things. In the stories of the Schwatzenegger mouse and Dougie the extra smart mouse, in each case we were conscious that claims were

being made by the university public relations department that might not have been made by somebody standing up on a platform and talking to his colleagues. But we made a story out of it any way and stuck in the provisos. We don't go in for caveats though we put them in perhaps once. Our propositions are usually harder than those phrased in science papers.

I don't get a lot of complaints from scientists though. When I ring up people like Paul Nurse or Jon Sulston they ring me back, they're still speaking to me so they probably think I'm more or less reliable.

*Were you a science graduate?*

What formal scientific education would be any use if I acquired it in 1956?

*Would it give you a general background of scepticism and a scientific frame of reference?*

That's what we do any way. The most famous question in journalism, the one that every reporter asks himself is, "Why is this bastard lying to me?" Although we report what they say we go to some lengths in the story to indicate that this may not be the case. That's a normal part of reporting. Science and journalism actually do have a lot in common. Journalists and scientists are both of the human sub-species that are excited by the words, "I don't know". Accountants and other people seem to believe if you don't know then there's not point in doing something. Whereas we always think, what is it I don't know, why don't I know, and how would I find out? That's exactly the scientific process, only faster and with a shorter attention span. We get bored easily is the short answer. The other thing is that the more you know about a subject the less you see. It's actually very helpful to have some sort of innocent awareness of how the rest of the world sees it so that you don't bore them stupid talk over their heads or skip bits that really do matter in pursuit of an advance that actually doesn't matter. We tend to think in terms of stories that

can be told in one sentence. "What's the point of the Ulysses space project?" and the answer is, "Set the controls at the heart of the sun," if you're a Pink Floyd fan. You think in bright images and glib words, don't regard glib shallow or facile as insults. I think if there were more people going round being glib shallow and facile we'd all understand each other a lot better.

***Would you consider genomics your area of interest around genetics?***

No, genomics didn't exist five years ago, it's another thing you had to learn about as it came along rather like having to learn about globalisation or the new generation of cruise missiles. Genomics was a non-science which has only just emerged but it's obviously very important and we don't know much about it. The next twenty years are going to be much more fun in that respect. There's so much to learn you can say we know nothing now. It's a fairly comfortable position to report from, I don't fancy being around to report on the precise probability that if you have three breast cancer genes you're going to get breast cancer and when. At the moment you can talk about the air being bright with promise and all sorts of things happening but not for at least a decade.

The answer to your question though is that I cover everything from archaeology to zoology and then some.

***What do you feel to be the primary motivator in coverage - reportage or analysis?***

You do make judgements, when you choose a story you're making a judgement, you're adding some sort of value, some sort of context or background, there's always a bit of analysis. Although there are things about science which are non-negotiable the arguments people make from it and the things they do with it are all too human.

*Through what lens do you most frequently analyse a story?*

If I thought it had been done by Mystic Meg I wouldn't report it. If I think its been done by a scientist who has a reputation to lose and its been published in a journal which has a record of sound publication, I then say well bloody run it whether its true or not. So you might say that the criterion I use is, "Will people read it?" That's an oversimplification but it's basically the plan. But it's not a frivolous criteria because the news affects us, it includes important news and trivial. There's also a human element to a story.

*What do you view as the Guardian's stance on genetics?*

It is there, like the Palestinian conflict, it is there and what are we going to do about it. That's our stance. A paper like the Guardian has a long history; we started with the Peterfields massacre in Manchester. We are much more aware than say the Daily Telegraph of how authority uses technology, how people are controlled and how people are abused and hurt. There would be as keen a folk memory here as anywhere of the peculiar horrors of eugenics, which were genetics the last time round. Probably there was a sharper awareness than most when Dean Hammer of the National Cancer Institute in the US announced in 1993 that a length of chromosome inherited from the mother was associated with rampant homosexuality. It was picked up as the gay gene. What was most interesting about that was someone from the Daily Mail stuck up the headline, "Abortion hope after gay gene find". That's the problem, if you ask, "Do you have an ideological position?" the answer is yes I do because I know how people will miss-use it.

The comforting thing about genetic research so far is that the whole idea of race doesn't make any sense. But you try and tell that to the national front. People are going to make abuses for a while, eventually though people maybe be educated out of it.

I really distrust the idea of the behaviour genes. Even when they turn up they don't make sense, I don't see how the gene [transduction pathways] turn into being Rupert Murdoch or Bill the Thug I don't think behaviour is simply genetic at the crude level people would like it to be at. You can see how it could be abused, that's my political opinion.

*How do you view the role of the press in relation to genetics?*

Well that's a piece of string question isn't it? To a certain extent genetic research has happened because the press has written about it. That is, there is a direct relationship between the perceived importance of a subject and the amount of money politicians are prepared to put into it and the fuss the public make. If the public perceives something is important then the research money gets through quicker. So by reporting it we help to make it happen. The guess is that even the race between the HGP and Craig Venter was influenced by the press. The press certainly had a roll in accelerating and whipping up interest in the race and making sure they both finished on time. By making heroes of scientists and making demons of them we have our part to play. We also draw attention to the possibilities for research, therefore making it easier for funding to go through. If the press had not picked up the embryo stem cell debate quite as quickly... we were all on to that one immediately. Most really amazing science doesn't get announced publicly. It gets published and then, somebody says, "God those homeobox genes really matter don't they?" months or years later. But when the guys in Michigan announced, shortly after Dolly that they had managed to immortalise embryo stem cell and then use them, we all instantly saw what was going to happen. The combination of the Dolly technique and this actually gave you self-transplants. We didn't consult but we all ended up running pictures of Mohammed Ali and Christopher Reeve. The press did have a role in pushing the debate through successfully in Britain and probably unsuccessfully in the US because of crazed right wing columnists providing Bush with the kind of words he wanted to hear.

We do have a role but this is a democratic obligation we're not doing this for science we're doing it because that's one of the things we're supposed to do, protect and assist democratic debate.

*What do you think are the limiting factors for scientists in their interactions with journalists and vice versa?*

I don't think there are any, the idea that a scientist isn't a citizen is ridiculous, they are scientists for only a sliver of the day and the rest of the time they're fathers' husbands' and drunks like the rest of us. There are technically no limits, there are problems though, language is one, the gulf of knowledge is another one, the third one is attitude, a lot of scientists just want to get on with doing their own work. The answer is no, what they are doing, they are doing for the rest of the human race so they have an obligation to share that with us. A bit of give and take is required on both sides but mostly give because we'll take it anyway.

*How would you rank time and space constraints with this list?*

Time and space is our problem everyday. In practice I won't be given more than 600 words to tell my story on a news page and that's a space constraint. They're a daily fact of life. Its tomorrow's issue that matters.

*Would you concede that they are less important constraints for your style of journalism, as many of the stories you publish are background rather than news?*

In the sense that we could publish a story tomorrow I suppose not but I think you'll find very few people here think in those terms, as I said before its today's deadline for tomorrow's issue that matters.

*What would you consider to be the ideal story?*

The ones I prefer are the slightly ridiculous ones, I find it much easier to get a person to read something amusing rather than something that's dull. There are some stories that people will just read whatever, you can't write them badly, like the Berlin wall coming down. The ones that give us a complete surprise are the best ones. That's what I call an ideal story and genetics doesn't actually come into it. Science can be quite good at show business too, the HGP actually got through on showbiz. They went out and got us involved. Some of them got very rich; it's made fortunes and built up terrific reputations. Lots of good will come from the project and we were part of it but we didn't do it to support scientists.

*Do you think that science coverage might benefit from a more methodological approach?*

I think I already have a method as a journalist and that's the five Ws, who, what, where, when and why?

## **Appendix 3**

### **Interview with Prof. David Cove 15/3/03**

*Are you happy with the media coverage of genetics in general?*

No I don't think I am happy with it in general. I think there is an inevitable tendency to sensationalise results, to emphasise negative results in particular when it comes to some areas and perhaps to over emphasise positive results when it comes to others. The contrast is between the use of genetics in biotechnology and the use of genetics in medicine. The general level of coverage in medicine is positive and the general level in biotechnology is negative. Actually in both cases the coverage is therefore distorted.

*Do you think this is the result of an inadequate risk assessment?*



No I don't really think it's that, I'm afraid that it's probably just what sells a newspaper that motivates the press. They tend to give the public what they *think* the public wants. The public would like to think there's a gene for cancer so, "Gene for Cancer Isolated," becomes a big headline even though that's not really what the scientist has done.

***How do you view the role of the press in relation to genetics? In actuality? Ideally?***

I don't see that the role of the press should be any different in relation to genetics than it should be in relation to anything else. I think that newspapers should publish news. The thing that I notice about press coverage of genetics even in broadsheets is that usually it contains inaccuracies. I suppose therefore, by extrapolation I must presume that every single article in the broad sheet contains inaccuracies. Unreliable is perhaps not the word I guess selective rather than unreliable.

***Do you think that's because many reporters don't use provisos, which provide more accuracy?***

Yes I think that's true. Obviously that means scientists, who you can probably claim by and large are intellectually honest, are never positive about any thing. That gets up the noses of both politicians and the press. I remember being interviewed on Radio Four sometime ago about a reported gene for some aspect of criminality. In the run up to the interview I spent about half an hour trying to give the interviewer my stock tutorial on genetics and the complexity of the interplay between genes and the environment. At the end of the half-hour she said, "OK. I

understand all that - but what's the bottom line - is there a gene for criminality?" She was not prepared to accept it was not a simple question to answer. It's like asking a geographer how far is it from one corner of the earth to the other. You know the earth doesn't have corners and similarly geneticists know there aren't genes for things. Whereas opponents of biotechnology can be absolutely dogmatic and positive the proponents have no such position, at least I wouldn't trust them if they did.

*What do you feel are the benefits and diss-benefits of press coverage to genetics?*

I'm an out and out democrat and therefore the benefits clearly are to have a well informed society. The diss-benefits would be if they informed society ill. One suspects that's what they manage to achieve quite often, although you can't tar them all with the same brush. Science coverage varies even between the broadsheets. On the subject of biotechnology the BBC and the Guardian have a constant 'anti' attitude which one would not say was particularly balanced. I dread to say it but the Telegraph seems to have rather the best coverage of genetic biotechnology. They're all much more even and similar on medical genetics though.

*Would you assign that to the editorial policies of those papers?*

It's possible that it could be editorially driven.

*What do you think the benefits of media surveys such as this could be for geneticists?*

Since I believe that there are great benefits to society from genetic research and also diss-benefits, particularly in the area of human genetics, I think it's essential that the public debate is wide and informed. So clearly the benefit of having accurate press coverage is you'd get more people participating meaningfully in the discussion.

I don't see why the media should be exempt from the same sort of scrutiny that they'd like to give to anyone else.

*In such surveys what would you consider the most interesting axis of inquiry?*

I've never done such an analysis so I've really no idea. I'd be interest to see if there were temporal trends especially in attitude. Research has been focused more and more on direct benefit rather than fundamental research, which I actually think is very wrong. If you don't have fundamental research now you don't have the applications in fifty years time. That actually means that research has become more and more relevant to society, this year maybe and a lot less relevant to society in another generation. It's the media I think that have been largely responsible for this turnaround. It's fairly easy to find causes, its clear that BSC for example was one of the major reasons and that had nothing to do with scientists. That was a result of the greed of the food processing industry as far as I can understand and that of course results from capitalism.

*Is that financially motivated?*

Not to the gain of the scientist, I guess industry scientists have slipped well behind any other profession in the last thirty years. I've just conducted a survey of the committee members of the Genetics Society on the government's discussion paper on higher education. One of the specific questions they were asked was, "Did they think that a substantial rise in scientist's salaries would lead to an improvement in scientific research?" and unanimously their answer was no. They all say none of them do research because of financial gain, of course this is a subset of

scientists though. But financial gain drives everything so of course it's financial gain that causes the *government* and *industry* to fund short-term research. Its short-termism and we constantly discuss how to get over it.

*How do you view the role of the press in that process?*

The press could play a role there by criticising short-termism but no, most of the press are only too keen to say, "Why should we waste tax payers' money". They often ridicule a story if they get it in the area of sociology for example.

*How about the Human Genome Project?*

It's only just started. There's no doubt at all that the people who sponsored it wanted to make a splash in the press so they're as guilty I suspect as the press.

*What do you think is the rate-limiting factor for scientists in their interaction with journalists?*

I think the rate-limiting factor is that the majority of journalists I speak to are not scientists. If the press and the media in general employed more people who at least had the background knowledge it would be easier for them to understand and therefore write more accurately.

*Would you say time and space is less limiting?*

Yes, I sometimes notice a newspaper will publish a news item way after it first comes to the attention of scientists, they can be quite late to pick it up.

*What would you consider to be the ideal story?*

I'm realistic enough to recognise that an ideal story is one that sells newspapers as a result of it being read. It would be facile for me to say an ideal story is one that gives a good balanced view of the truth.

*What dimensions would such a story explore?*

I think the role of newspapers is to take it further than reporting the science. They can certainly have opinions, balanced opinions on the use of science. In a utopian situation I guess scientists are responsible for harvesting knowledge but not responsible for the use of this knowledge. A democratic society would reckon that its democratically elected leaders should be responsible for the use of such knowledge. I guess in the end that it's the media's role to inform this society. So an ideal story will inform and point out the advantages and disadvantages and possible use. I've not seen enormous highlighting of the problems of genetic finger printing with respect to the insurance industry for example. One suspects that newspapers are actually rather wary of the insurance companies. If you follow it through logically as we did the other day [at the Royal Society speaking out forum] once you really have a firm handle on someone's predicted life span, no one's going to insure them if it's a short life span. It would be the end of private insurance and therefore the state would have to take over. One wonders why these sorts of stories have not

been highlighted in the press. Because I'm a conspiracy theorist I reckon it's because the insurance companies are far too powerful. They're not going to print "the death of insurance" as a headline.

*Do you think that scientists or journalists could benefit from a more methodological approach to coverage?*

I'd be prepared to be convinced but I'm not quite sure what difference that would make, I think that it might be a little contrived. We do have a very insular analysis of the effects of GM in Britain and Europe. The global dimensions of stories are just not emphasised enough. GM crops are much less relevant to us in the western world that is self sufficient in food than in the developing world. I don't really see too many stories on this. There was a paper on the growth of GM cotton in India a few weeks back which didn't hit the headlines as much as it should have. It was a clear example of lower pollution, higher yields and higher profitability in the developing world. One suspects the Guardian would lose readers if they started publishing good stories about GM.

*What method do you employ to analyse science?*

Well the first thing I hope I always emphasise to all my graduate students is that you should never believe a word of science including your own results. It has to be falsifiable and reproducible for it to be good science; you must never rely on a single result. The thing that's most difficult to convince bench scientists of is that their observations are unconsciously biased by the goal that they want to achieve. A good scientist always guards against getting the results that he or she wants.

*What method should the public use?*

I think a similar level of scepticism would be a good starting point.

## Appendix 4

### Email interview with Roger Highfield (Science Editor of the Telegraph) 17/03/03

*Are you happy with the media coverage of Genetics in general; that is within the Telegraph, in other publications and in other media?*

No. I would like to get more into the Telegraph (but that is a complaint of all specialist correspondents, and we have just published a three page DNA special - more than any other paper on the anniversary). As for other papers, I am amazed at the hysterical rubbish written by some pundits and generalists.

*How do you view the role of the press in relation to genetics?*

I don't. We are here to sell newspapers to our readers and I select subjects I think will be of interest.

*What do you feel are the benefits, if any, of media surveys or an increased awareness of the manner in which the press operates, to scientists?*



Scientists have to be aware of our main agenda - to serve our market. That agenda produces different results, depending on whether you write for the Mail, the Sun or the Telegraph. On the Telegraph, for example, we do much more than report on science. We have sponsored the Cheltenham Science Festival, run science writing and photography competitions, organised mass experiments with the BBC, conducted Gallup polls and expert polls, organised seminars on themes as diverse as ice cream, chocolate and hair, run an annual scientists meet the media party, and done a host of other things to shed light on science in society.

***In a media survey of coverage of genetics what would you consider to be the most interesting axis of inquiry?***

For me, at least, I would like to shed light on risk perception, how to frame unknown risks in terms of known risks and so on. And how to avoid the naturalistic fallacy present in a lot of environmental scare stories. I also wonder if the average scientist behaves any differently from the average member of the public and whether the latter treats contradictory media

reports in a much more sophisticated way than we appreciate.

*What do you ascribe as the rate limiting factor for journalists in their interactions with scientists?*

Time.

*What would you consider the ideal story to consist of?*

Jesus cloned.

*Do you think that journalists or scientists might benefit from a more methodological approach to coverage?*

I already use a methodological approach. I select a story I think will be of interest to 2.5 million readers. I research it, contacting people who know about the story. I write it. The night editor decides whether it gets in the paper, depending on space and other news priorities. Not sure how to make that more methodological.

*How do you decide which stories to cover?*

By what interests my 2.5 million readers.

*Through what lens do you most often assess a story? What axis of inquiry do you choose most often in writing a story?*

ditto

*What do you view as the Telegraph's stance in relation to genetics?*

Speaking personally, I distrust all statements made by multi nationals with something to sell i.e. companies desperate to sell products and environmental groups desperate for subscriptions. The last time we debated genetics within the paper, it was felt that fears about GM food were overstated and that fears about effects of GM crops on the environment were worth closer study. Crucially, we are not fundamentalists who are opposed to GM in principle. There are bound to be some good applications and some

bad, like any technology.

***How much do you trust scientists and on what do you base that assessment?***

There are always exceptions. However, I think they fare well compared with other expert cultures, particularly at the harder/mathematical end of the sciences (fraud, for example, is relatively rare in physics compared with molecular biology). I have only one other point of reference. Years ago, I wrote for a medical magazine and found doctors could be both arrogant and not particularly well informed. Even a decade ago, I am not sure your average surgeon knew what a randomised controlled trial meant. The fact that Doctors still like talking about evidence based medicine says it all. As far as I am concerned, all medicine should be evidence based.

## **Appendix 5**

**CD containing raw data from media survey in MS Word and statistical analysis in MS Excel**

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