MEDIA REPORTING OF NETWORKED KNOWLEDGE

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ABSTRACT

We argue that growth in networked knowledge challenges existing roles of actors in a media communication system. Knowledge production is becoming increasingly multidisciplinary, international and dispersed over many different organizations and institutions (Nowotny, Scott, & Gibbons, 2001). Instead of being expert, discipline-bound and self-referential, networked knowledge production is transcending disciplinary and institutional boundaries with research agendas and new knowledge production negotiated and shaped in interaction among stakeholders in localized contexts (Gibbons et al., 1994). As a consequence new knowledge is confronted and tested in different contexts and through public debate rather than traditional disciplinary scientific criteria.

A content analysis (Collis & Hussey, 2003) of news reporting on biotechnology in a New Zealand daily newspaper over an eleven year period is used to support our argument. Public science actors currently articulate their views on a number of themes that are associated with traditional research agendas. However there are a number of themes where the views of public science are not reported and the implications of this in a networked knowledge era are discussed. Journalists increasingly need to report on a wider range of actors and their views about networked knowledge production, rather than translate peer-reviewed science for public consumption. Similarly institutions and organisations need to present their views and activities in ways that that can be understood by the society, not just their colleagues in peer-reviewed publications.

Keywords: Knowledge networks, Research Commercialisation, Public Science,

With no single organisation possessing all the competencies needed for generating research breakthroughs knowledge production is becoming increasingly multidisciplinary, international and dispersed over many different organizations and institutions (Nowotny, Scott, & Gibbons, 2001). This shift towards networked knowledge production has significant implications for the institutions, norms and process associated with the production of such knowledge. Instead of being expert, discipline-bound and self-referential, networked science production transcends disciplinary and institutional boundaries. Increasingly research agendas and new knowledge production are negotiated and shaped in interaction among stakeholders in localized contexts (Gibbons et al., 1994). As a consequence new knowledge is confronted and tested in different contexts and through public debate rather than tested against disciplinary scientific criteria.

Examining media reporting biotechnology over a period of time provides insights into the conditions under which media influences or reinforces public opinion (Bauer, 2005) about science-based knowledge
production. Media is one outlet where actors in the society initiate, explore and debate these issues. Media is part of a communication system where actors mobilize resources to draw attention to certain activities. Media influences public perceptions through the timing of attention, distribution of awareness and knowledge, directing of attitudes, framing of contents (Bauer, 2005; Hornig Priest & Ten Eyck, 2003) and conferring salience on certain issues (Gregory, 2003). In this paper we argue that as science-based knowledge is increasingly produced through knowledge networks, the lay public are less likely to understand the complexity of such activities. This challenges the roles of actors a public communication system from one in which journalists are translators of peer-reviewed science for public consumption towards one in which journalists report on a wider range of actors and their views about networked knowledge production. Similarly institutions and organisations need to present their views and activities in ways that that can be understood by the society, not just their colleagues in peer-reviewed publications.

The paper begins with an overview of the growth in networked knowledge with commentary on its implications for the negotiation and shaping of research agendas and future knowledge production activities. This is followed by a review of literature about media and its role in articulating and shaping how the public view science, which leads to the three research questions of this paper 1) which frames are used to present biotechnology in New Zealand’s media? 2) in what ways is public science represented? 3) and how often? The third part of the paper outlines the research methods for answering these questions and the fourth part of the paper analyses the findings. We conclude with a discussion of the implications of media reporting for public debate, understanding and acceptance of networked knowledge.

Knowledge networks and the production of scientific knowledge.

Knowledge production is becoming increasingly multidisciplinary, international and dispersed over many different organizations and institutions (Nowotny, Scott, & Gibbons, 2001). In rapidly developing technological areas no single firm or research institution possesses all the needed competences needed for generating research breakthroughs. Knowledge creation and innovation demand a combination of
scientific skills and intellectual abilities that normally exceed the capabilities housed in a single
corporation (Powell, Koput, & Smith-Doerr, 1996). The needed, often very sophisticated, knowledge is
widely dispersed among universities, research laboratories, competitors, customers and suppliers. The
rapid pace of technological change requires that firms take advantage of knowledge networks in order to
further develop their organizational capabilities and maintain competitive advantage. As opportunities for
learning and knowledge creation are dispersed throughout the networks, the network relations provide
critical knowledge that allows individual corporations an edge towards innovation and aid in the
development of new opportunities.

Innovation-based competition, the speed of technological change, increased globalisation (Miotti &
Sachwald, 2003) increased dependence on diversified knowledge bases (Granstrand, Patel, & Pavitt,
1997), multidisciplinarity in research (Nowotny, Scott, & Gibbons, 2001) the innovation ability of
network (Powell, Koput, & Smith-Doerr, 1996) and also declining cost of monitoring and exploiting
networks (Narula, 2004) are all factors that stimulate companies to use make extensive strategic use of
external networks and R&D collaboration (Duysters, Kok, & Vaandrager, 1999). As a result,
organizations are slowly evolving from “well-structured and manageable systems into interwoven network
systems with blurred boundaries” (Seufert, von Krogh, & Bach, 1999, p. 180). It has been claimed that
networks collapse the boundaries between places, temporal states, and organizations (Castells, 1996).
Space is structured in flexible flows rather than as static places, the time regime has replaced the linear
clock time with global and cyclical timeless time, and organizations are parts of integrated structures
rather than discreet units. Time, place and organizational association are considered less influential on the
ability of networks to integrate people, places, and organizations, with the aim to maximize value creation.
The networking logic is related to the role of science in the innovation system in at least two respects:
first, knowledge-producing organizations are ideally integrated into value creating networks and
innovation systems; second, science itself is to a growing extent organized according to the networking
logic, where the development of the most dynamic and advanced research areas take place within global knowledge networks.

**Governance of Networked Knowledge**

A shift towards networked science production has significant implications for the institutions, norms and process associated with the production of scientific knowledge. Instead of being expert, discipline-bound and self-referential, networked science production is transcending disciplinary and institutional boundaries where research agendas and new knowledge are negotiated and shaped in interaction among stakeholders taking part in the collaboration on a problem defined in a specific and localized context (Gibbons et al., 1994). As a consequence of the change toward mode 2 production of knowledge, new knowledge is not primarily tested against inter disciplinary scientific criteria but confronted and tested in different contexts and through public debate. Now we turn to explore media and its role in articulating such knowledge to the lay public.

**Media and Society.**

Media is one outlet where actors in the society initiate, explore and debate issues. Examining media reporting of science, scientific discovery and related activities provides insights into the conditions under which media influences or reinforces public opinion (Bauer, 2005) about science-based knowledge production. Media is part of a public communication system where actors mobilize resources to draw attention to certain activities. When public opinion in the media and general conversations and perceptions in other public arenas resonate on a particular issue they are framed and augmented in ways that inform attitudes on that issue. Framing theory as described by Goffman is commonly used to examine this. Media reporting frames select aspects of a perceived reality and present that reality in ways that give particular views salience (Entman, 1993 cited in Segvic, 2005). Frames are basic cognitive structures that guide the perception and representation of reality (Goffman, 1974). They are created as we build our subjective understanding of an event. They are not consciously manufactured but are unconsciously adopted in the
course of communicative processes. Frames structure which parts of reality become noticed (Koenig, 2004).

Media influences public perceptions through the timing of attention, distribution of awareness and knowledge, directing of attitudes and framing of contents (Bauer, 2005; Hornig Priest & Ten Eyck, 2003) and confers salience – “it tells us not what to think, but what to think about” (Gregory, 2003). Gregory (2003) argues that in a knowledge society those who are better equipped intellectually to find and use information are more likely to engage in public debate. Hence, media coverage of public debates extends knowledge gaps between the informed and less well informed. Furthermore as science-based knowledge increases the lay public are less likely to understand the complexity of such activities.

**Media and science**

Science communication is a malleable tool that is used by both senders and receivers to achieve their various purposes (Gregory, 2003) This includes drawing attention to successful scientific breakthroughs, highlighting policy and funding issues and raising profiles to attract the attention of potential partners for innovation-based competition. For example, during the 1980s UK scientists used media communication to voice their concerns about the funding cuts and staff retention issues. They articulated their position as one of society not valuing the contribution of scientific research due to poor public understanding of science (Gregory, 2003). Throughout the 1980s and 1990s Monsanto used media as part of its communication strategy to define biotechnology in a way that is acceptable to the public(Kleinman & Kloppenburg Jr, 1991). In the late 1990s biotechnology firms used press releases outline the ‘successes’ of cloning breakthroughs and articulate the research in a positive way (Mcinerney, Bird, & Nucci, 2004).

The relationship between the media and the science community is contested on a number of dimensions (Bubela & Caulfield, 2004; Caufield, 2004; Gregory, 2003). Media are a powerful disseminator of knowledge and have been criticised by the science community for under-reporting science (Gregory,
2003). In their analysis of UK print media from 1946-1990 Bauer et al (1995) found that science represented 5% of all reporting in UK print media and given the few resources that the science community has to promote itself activities, this is a high coverage (Gregory, 2003). This shows that there is a gap between scientists’ perceptions of media reporting and the amount of coverage given to science. However, what these empirical studies of print media do not address is the content of what is reported.

The public receives most of its information about science from the media (Caufield, 2004). There has been concern from the science community that the public are misinformed about science due of poor reporting. Caufield (2004) citing studies by Wilkes and Kravitz and Bubel and Caufield find that 3% to 11% of science is inaccurately reported in the media. However, Bubela and Caulfield (2004) claim that inaccurate reporting is not the real issue. They argue that uncritical reporting or embellishment of peer reviewed science is of greater concern. It is understandable why reporting of peer-reviewed science is uncritical when we consider the role of journalists as actors in the communication system. As reporters journalists are tasked with translating specialist knowledge into information that the lay public understand. Given the increasing sophistication of new scientific knowledge (Nowotny, Scott, & Gibbons, 2001) and the dispersal of understanding of knowledge across multiple organisation boundaries (Powell, Koput, & Smith-Doerr, 1996) we might expect to see increasing uncritical reporting as journalists are tasked with interrupting increasingly complex science.

Another concern about media reporting of science is ‘Genohype’ or the over-hyping of genetic research. Public Science institutions and their researchers are under increasing pressure to demonstrate the potential economic value that science adds to society. This leads to some research being reported in a manner that over-emphasizes the potential benefits (Caufield, 2004). Such reporting has an adverse impact on the public understanding of science-based innovation as the public are provided with a simplistic understanding of the true costs and time-frames involved in commercialising science.
Publics’ relationship with scientific knowledge production is also constructed through commercial activities as much as through the ideas of the academy. Historically the commercial sector has been slower than the academy to engage with the public around science (Gregory, 2003, p. 137). However as knowledge production occurs in networks that public science institutions are involved in private sector organisations will be challenged to engage the lay public in the negotiating and shaping of their research agendas (Gibbons et al., 1994). We expect that such negotiation to be articulated in the media.

**Media and new technology**

Media play a strong part in shaping broad democratic debate concerning the development of science and technology (Hornig Priest & Ten Eyck, 2003). Media reporting draws the public’s attention to issues and in doing so it alerts interest groups to issues that they might wish to debate. As parties articulate their beliefs through the media, prevailing views are challenged. This stimulates the flow of information to reduce gaps between the informed and less well informed; it encourages the circulation of knowledge and maintains the involvement of citizens in debate and decision-making about public science (House of Lords, 2000 cited in Gregory, 2003). While this is a complex and potentially confrontational process, it is a necessary precursor to the accommodation of new technology movements (Gregory, 2003) and mode-2 knowledge production (Gibbons et al., 1994).

New technology movements must mobilize support for public funding, venture capital, qualified labour and public goodwill to put forward arguments and future scenarios to ensure acceptance and ongoing support from the society. Biotechnology is an example of new technology movement whose appearance in the media has been well studied (Bauer, 2005). In America and Europe biotechnology has been legitimised as a new technology through the space and attention it has gained in the media where media coverage of the cloning debate was unprecedented (Bauer, 2005; Hornig Priest & Ten Eyck, 2003). Despite the attention given to the topic debate on the two continents developed in different directions. In the US the debate focused on the commercial opportunities, whereas the debate in Europe concentrated on
the unintended consequences. These debates about cloning illustrate that the traditional view that new knowledge can be tested by science and industry against scientific criteria (Gibbons et al., 1994) is no longer accepted by society (Bauer, 2002). Rather, public views as a legitimate sources of opinion in the debate about new scientific knowledge must be attended (Bauer, 2002; Gibbons et al., 1994).

This study poses three questions:

1. Which frames are used to present biotechnology in New Zealand’s media?
2. In what ways is public science represented?
3. And how often?

In exploring how biotechnology as a complex scientific knowledge output is articulated in New Zealand’s media, we analyse how the views and activities of actors in knowledge networks are presented. We then discuss the implications of current articulations in the context of negotiating and shaping the research agendas for networked knowledge.

**METHOD**

**Content analysis of biotechnology reporting in the media**

A content analysis was undertaken to explore how biotechnology is articulated and how public science is represented in the media. Content analysis involves the conversion of text to numerical variables for quantitative data analysis (Collis & Hussey, 2003). The content of newspaper reporting was analysed using framing theory. Framing theory argues that frames are central organizing ideas that provide meaning to events, to portray the essence of a story (Gamson and Madigliani, 1987 cited in Segvic, 2005) and guide the perception and representation of reality (Koenig, 2004). Framing Theory is commonly used in the analysis of media reporting because it demonstrates how certain representations of ‘truths’ become noticed, negotiated and adopted into society through the a public communication process.

*Media Frames.*
A frame is a structure that (i) organizes central ideas of an issue (ii) deploys particular symbolic devices and metaphors and (iii) defines a particular phenomenon in a certain way (Hibino & Nagata, 2006). A number of frames are identified in the media to organize central ideas of an issue and these have been used in previous media studies of biotechnology (Durant, Bauer, & Gaskell, 1998; Hornig Priest & Ten Eyck, 2003; Horst, 2003). Main New Themes (Genetic Identification and 4 sub-categories, Transgenic and 3 sub-categories, Safety-Risk, and Other and 14 sub-categories) and Main Reference Actors (Institutions, Public Sector and 12 sub-categories, Private Sector and 5 sub-categories) were adopted from Durant, Bauer, & Gaskell (1998) for this study.

**Sampling.**

To create a dataset of media coverage of biotechnology in a daily newspaper over time, a sample of articles were selected. Following Bauer’s (2005) method articles associated with biotechnology were selected from the Wellington-based daily newspaper The Dominion Post. First a full-text search of the ANZ reference centre database was run for all references to “biotech* or genes or genet* or genom* or DNA or clon* or ivf or intro or vitro or "test tube bab***" or "stem cell" or "clinical trial" or bio or bio waste or "medical device" or "medical imaging" or "medical diagnostic" or biochem* or "functional foods" or nano***”. These terms and phrases are symbolic devices and were used to identify relevant articles. The time period January 1995 to December 2006 inclusive was used as sampling across a time period provides an index of the intensity of biotechnology reporting and a measure of changing salience in a single media outlet over time (Bauer, 2005). Furthermore, a number of public debates have occurred in New Zealand during this time.

From this search a total 3057 articles were identified. A sample of 7.5% (241 articles) was selected for analysis. The sample of articles for each year was taken proportionate to the total number of articles reported for that year from the whole population (see Table 01). We are interested in how journalists frame or define a particular phenomenon in a certain way (Hibino & Nagata, 2006) so other media formats
including editorials, letters to the editor, advertising and advertorials were omitted. If the paper selected was not a news article the next item was selected.

In this study the unit of analysis is the newspaper article in which biotechnology appears as a main focus. Following the method used by Horst (2003) articles were categorised as having a biotechnology focus when the topic was articulated in a full paragraph (i.e.: more than one sentence). During the coding process articles that did not fulfil these criteria were disregarded. This left us with a sample of 129 articles for analysis.

Findings

The increasing number of articles reported in the Dominion Post from 226 in 1995 and 355 articles 2006 suggests that the salience of biotechnology in New Zealand media increased during the 1990s to peak of 392 articles in 2002. In 2004 reporting dropped significantly to 200 articles, but in recent years has started in increase again. Debate about the ethics and commercialisation of genetic engineering captured the interest of many actors in many western countries during the 1990s including New Zealand. The growth in biotechnology reporting occurs during periods of extended public debate about genetic engineering, particularly in food production, field trials and the Royal Commission on Genetic Engineering.

Location of biotechnology-focused news. The location of biotechnology-focused news reporting is dominated by coverage of events in New Zealand (82.4%). The US (5.6%) and Australia (5%) were other locations of reported biotechnology-focussed news. ‘Other” (7%) countries included the UK, Europe and South America. While reporting is oriented towards national reporting is similar to news reporting elsewhere (Crawley, 2007) from a knowledge network perspective we might expect to see an increasing coverage of biotechnology news outside of NZ.

Main Reference Themes. The main reference themes most commonly represented in biotechnology-focused reporting are an assortment of sub-themes clustered in the Durant, Bauer, & Gaskell (1998) study
as “other issues” (58.1%). This was followed reporting on Genetic Identification (26.7%), Transgenic issues (10.5%) and Safety/Risk issues (4.8%). A clearer picture of reporting on main themes is provided by analysing the sub-themes (see Graph 01). We can see here that reporting is distributed widely across many issues. The sub theme most commonly reported on is Gene Identification for the purposes of criminal investigation (11.4%), followed by Gene Identification for other purposes (8.6%), Agricultural Biotechnology (7.1%), and Economic Prospects, Opportunities (6.7%).

Main reference to actors. Actor categories most reported as the main reference actors are Government Departments and Agencies (22.6%), Firms (21.5%), Public Science (23%) and Stakeholder Groups (14.7%). For the purpose of this study main reference actors involved in public science are of interest to us, and it is here that we turn our attention.

Main Reference to Public Science Actors. We divide Public Science actors into three sub-categories: Crown Research Institutes (CRIs), Universities, and Other Public Science. The 'Other Public Science' sub-category includes non-NZ universities and any other Public Science. The 13 items categorised as 'Other Public Science' in this sample seem to be of an ad hoc nature and are not analysed further in this paper. CRIs and universities appear as Main Reference Actors in 30% (39 of 129) of articles in this sample. Their appearance as main reference actors in relation to main reference themes tells us about the way in which public science is involved in the articulation of biotechnology in New Zealand’s media. These are discussed next.

Crown Research Institutes (CRIs) as Main Reference Actors. Of the 129 biotechnology focused articles analysed, CRIs appear as a main reference actor in 28 (21.7%) articles and across 13 of the 21 theme categories (See Table 02). CRIs appear as the main reference actor most often when the main theme is Agricultural Biotechnology, Economic Prospects/Opportunities, and, Science Policy.
We expect to see CRIs reported as main reference actors in Agricultural Biotechnology reporting for a number of reasons. New Zealand has strong agricultural history and the sector continues to make a significant contribution to the country’s economy. AgResearch, the main CRI working in this industry, has a well-established collaborative Research and Development program with industry stakeholders, which existed prior to the creation of CRIs in 1992. AgResearch have initiated a number of transgenic research programs that have gained media attention in relation to Genetic Engineering (GE) in New Zealand. The involvement of AgResearch in the GE debate is also reflected in the CRIs being reported as main reference actors in the Transgenic theme categories (see table 02).

We also expect to see CRIs reported as main reference actors in relation to Science Policy. Government’s Research Science and Technology policy impacts on CRIs in a number of ways. The strategic direction set by the Ministry of Research, Science and Technology (MoRST) sets out the government’s funding priorities. As commercial research units, CRIs seek financial support from competitive funding rounds administered by the Foundation for Research, Science and Technology (FoRST). As funding rounds are aligned with RST policy, the activities that CRIs might gain financial support for are influenced by government priorities. We also expect CRIs to be reported in relation to the Economic Prospects/Opportunities theme. The mandate of CRIs is to undertake technology research and development, including the commercialisation of applied science (ACRI, 2007). Therefore, we expect to see the reporting of such activities, including the patenting of new intellectual property and the commercialisation of it through joint ventures and spin-offs.

There are also a number of theme categories where we might expect CRIs to be reported as main actors, but they are not. These are the Ethics, Safety-risks and Financial/VC/Investment categories. We would expect CRIs to be reported on the Ethics and Safety-risk categories due to the CRI involvement in the Genetic Engineering (GE) debate. CRIs have expert scientific knowledge on the science, safety and
potential efficacy of GE that is valid to the development of public understanding about GE and society’s wider opinion of it.

We also would expect CRIs to be reported in relation to the Financial/VC/Investment category. CRIs are involved in a number of joint ventures and spin-offs and these commercial activities require private investment. There is evidence that CRIs are engaged in securing funding. For example, CRIs have secured financial investment from the NZ Venture Investment Fund (NZVIF) (NZVIF, 2006). As networked knowledge increases we expect that CRIs will become more involved in collaborative R&D networks. In order to the lay public to understand these activities and to participate in the discussion of the future directions these activities take we expect that CRIs will need to communicate their knowledge about the Financial/VC/Investment in biotechnology in the media.

*Universities as Main Reference actors.* Universities appear as the main reference actor in 25 (19.4%) of biotechnology focused articles across 13 of the 21 main theme sub-categories. Universities appear as the main reference actor most often when the main theme is Genetic Identification for diagnosis, prediction and testing purposes and Genetic Identification of ‘finger printing’ for other purposes. We expect to see universities as main reference actors in these two Genetic Identification categories due to the significant amount of basic research being undertaken using the human genome. A closer exploration of the 12 cases in these categories shows that the articles report on new scientific findings and the developments in the understanding of existing knowledge that are associated with basic research programs.

There are also a number of theme categories where we might expect universities to be reported as main actors, but they are not. These are the Education, Science Literacy and Science Policy categories. One of the main goals of universities is education. There has been significant debate in other countries about various aspects of science education and science literacy of the lay public. For example, the UK science community spoke out in the popular press about their concerns on the level of basic science knowledge in
the population and the impact this had on the public's understanding of the contribution science makes to society (Gregory, 2003). Given the value placed on science in New Zealand’s economic transformation, for example, see MoRST’s homepage that states “In all our activities we work towards our vision of science and technology transforming New Zealanders' lives”, we expect the views of universities on the development of biotechnology in the science curriculum, government funding of science education and the contribution of science education to NZ’s economic future to be articulated in the media. We are aware that some commentary has occurred, but it is not captured sufficient attention to be reflected in the sample of articles analyse here.

We also might expect universities views on research science and technology policy to be reported. Universities around the world faced challenges to public funding of teaching and research activities. Many pursue commercial science opportunities as a way of creating new revenue streams and some say that this is changing the purpose of universities. In New Zealand contestable funding that is made available through the Foundation of Research Science and Technology provides an important source of capital for early-stage applied science and capacity building that is necessary successful science commercialisation. Universities make important basic science contributions to knowledge networks and their interest in research commercialisation is growing. Access to funding and seed capital are critical issues so changes to science policy and its implementation affect universities. In order for the lay public to understand the changing role of universities and to participate in debate about the future direction universities take universities need to articulate their current activities and reasons for them in the media.

Conclusion.

Communication through the media reaches the lay public and this places high demands on journalists to report science accurately and present it in ways that non-scientists can understand. This is necessary in order for the lay public to understand the development of networked scientific knowledge and to participate in debates about future research agendas. The media frames science in certain ways that give
issues and events attention and priority. In order for the media to frame increasingly complex science production accurately, CRIs and universities as public science actors need to involve themselves in translating complex science into information that journalists and the lay public can understand. This is necessary so that the lay public are able to challenge, debate, negotiate and accept the future research agendas that knowledge networks pursue. In this paper we analysed biotechnology new reporting because biotechnology is an example of the increasingly complex scientific knowledge that is produced in networks. Our analysis of the framing of biotechnology news reporting in a New Zealand daily news paper over an eleven-year period suggests that that in some themes CRIs and universities as public science actors already articulating their activities for the lay public. We have also identified a number of themes where we expect public science views are not articulate and we have discussed why from a networked knowledge perspective this needs to change.

There are some limitations to this study that we must point out. Firstly the sample is drawn from a Wellington newspaper and drawing a larger sample from other national daily newspapers, such as the NZ Herald (an Auckland-oriented publication), The Press (Christchurch) and The Otago Daily Times (Dunedin) might provide a more accurate picture of public debate at a national level. Secondly, we are interested in how journalists frame or define a particular phenomenon in a certain way (Hibino & Nagata, 2006) so other media formats we omitted. Including editorials and letters to the editor as media formats through which the lay public participate in debate about science might provide further insights into which actor voices are articulated in the media and how debates, not just information, is framed.
Reference List.


Table 01: Sampling of The Dominion Post 1996-2006 inclusive

<table>
<thead>
<tr>
<th>Year</th>
<th>Total N = 3057</th>
<th>% of Total N</th>
<th># of Papers sampled</th>
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<tbody>
<tr>
<td>1995</td>
<td>226</td>
<td>7.4</td>
<td>17</td>
</tr>
<tr>
<td>1996</td>
<td>166</td>
<td>5.4</td>
<td>13</td>
</tr>
<tr>
<td>1997</td>
<td>211</td>
<td>6.9</td>
<td>16</td>
</tr>
<tr>
<td>1998</td>
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<td>7.0</td>
<td>16</td>
</tr>
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<td>1999</td>
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<td>316</td>
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<td>24</td>
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<td>2001</td>
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<td>11.2</td>
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<td>2002</td>
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<td>2003</td>
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<td>21</td>
</tr>
<tr>
<td>2004</td>
<td>200</td>
<td>6.5</td>
<td>15</td>
</tr>
<tr>
<td>2005</td>
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<td>18</td>
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<tr>
<td>2006</td>
<td>355</td>
<td>7.3</td>
<td>27</td>
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</tbody>
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Table 02: Public Science Actors reported by Main Reference Theme.

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<th>Main Reference Theme</th>
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<th>University as Main Reference Actor</th>
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<td>Biodiversity-organics</td>
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<td>Economic Prospects</td>
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<td>Ethics Main</td>
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<td>Financial, VC, investment</td>
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<td>1</td>
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<td>Gene ID (diagnosis, prediction, testing)</td>
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<td>Gene ID 'other'</td>
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<td>Gene IF 'finger printing' for other purposes</td>
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<td>6</td>
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<td>Horticultural Biotech</td>
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<td>Pharmaceuticals, neutraceuticals</td>
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<td>Reproduction, IVF</td>
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<td>Safety-risks (food, environment, worker)</td>
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Graph 01: Main theme of Biotechnology-focused News Reporting, Dominion Post 1995-2006