A report on Canadian and American news media coverage of nanotechnology issues.

Andrew Laing
President, Cormex Research

Introduction

Nanotechnology is not only a new technology, it is a new concept to many people. Since few work directly with nanotechnologies, most individuals are introduced to the technology through a variety of channels operating outside of the scientific community. These channels include popular culture vehicles such as *Star Trek* and Michael Crichton's novel *Prey;* business activities such as initial public offerings promoted by such as companies as NanoSys; government-led initiatives such as the U.S. National Nanotechnology Initiative and legislation such as the 2003 American 21st Century Nanotechnology Research and Development Act, as well as web sites, blogs, internet chat rooms and, of course, the mainstream news media. In combination, these mediated sources of information will likely shape how a very new science such as nanotechnology is ultimately understood by the public and how it is accepted (or rejected) by different groups within society.

The experience of the media and the general public regarding the early debate around biotechnologies such as stem cell research and genetically-modified foods provides a useful starting point to determine how media and public opinion may develop over time on the issue of an advanced technology. The concept of nanotechnology

currently is arguably similar what biotechnology was over a decade ago in that it is a technology that: a) has been frequently characterized as having far-reaching implications for health, science, industry and general economic development; b) is a subject that many among the general public are unfamiliar with;[18] and c) despite its many applications, the general public will rarely be aware of its presence in products and services. This context raises the importance of the media over other channels in influencing public perceptions and levels of awareness and acceptance of a new technology. In fact, important stakeholders have already recognized the role of early communications. The U.S. National Nanotechnology Initiative recently stated in a report that as "more and more new nanotechnologies are publicized and actually appear in the marketplace, the variable degree of social acceptance will become ever more important. Indicators to measure social acceptance of nanotechnology will be needed in the following areas: economic, political, religious and cultural" (Roco et al., 2001).

The purpose of the following paper is to examine one segment of the media – the news media – over a brief period in both the United States and Canada in order to provide researchers with an understanding of how the news media have covered this issue. The report will compare Canadian versus American media coverage in three areas: level of overall attention devoted to nanotechnology, the choice of news frames and placement of nanotechnology within the newspaper, and to what degree the benefits and risks of nanotechnology are presented to audiences. The approach should provide a basis to examine whether at this very early stage of introducing nanotechnology to Canadian and American audiences, the news organizations of each country are providing useful content from which to foster public understanding and debate over the technology.

Methodology

The sample consisted of fifteen Canadian and twelve U.S. print publications published during calendar 2004. A boolean search string was designed to extract all mentions of "nano" and its derivatives (nanotechnology, nanoparticle, nanotubes, etc.) and was applied to online search engines (Lexis-Nexis, FPInfomart, Cedrom-SNI and Factiva). The search yielded 942 news items, of which 381 (40%) were coded as applicable to the survey. Applicable items were those that contained at least one statement about nanotechnology; items with less than a statement were deemed to provide too little information about the technology to readers. The news item was the unit of analysis. News items were deemed inapplicable if: a) they used the term "nanosecond" as a colloquialism (3%); b) they used the term in obituaries, calendar of events or appointment notices (2%); c) the terms were cited in a table of contents or list (5%); d) they only cited a nano measurement, such as nanometers or nanograms (14%); e) or they contained only a one- word reference to nanotechnology (35%). By itself, it is

[18] A public opinion poll among 3200 Canadian and American respondents found that only 6% indicated they were "very familiar" with nanotechnology, and a further 32% stated they were "somewhat familiar". In comparison, 60% said they were somewhat or very familiar with biotechnology, and 75% stated they were somewhat or very familiar with stem cell research. Source: Canadian Biotechnology Secretariat. January 2005 Canada/U.S. Poll. 235 Queen Street, Ottawa, Ontario.

worth noting that over half of all mainstream media references to nanotechnology present the reader with no information about the term.

Each item was coded for a series of standard bibliographical variables (date of publication, type of news item, page number and placement, and reporter), as well as whether the item identified a clear individual and/or social benefit associated with nanotechnology, or a clear risk or concern. Seven broad benefits and seven risks or concerns were identified.[19] Two coders were used for the analysis, and reached an average intercoder reliability agreement using Krippendorff's *alpha* of 0.75.

As well as reporting the volume of news items, the results were also weighted based on the number of audience members that each news item might have reached. Audience reach for Canadian publications was determined using the NADBank 2003 total audience reach figures, while Audit Bureau of Circulation figures for 2003 were used for American publications. Moreover, in order to provide greater weight to more prominent and extensive news items on nanotechnology, each item's audience weighting was scaled using a nine-point rating determined by the extent and page placement of the mention of nanotechnology. Unless otherwise stated, figures used in the paper citing "audience exposure" are based on these weighted audience reach figures, given in number of impressions (number of potential readers of each news item on nanotechnology).

Results

Level of media attention to nanotechnology

Certainly the most notable characteristic that can be stated about media coverage of nanotechnology is the lack of it, with the survey indicating less interest in the subject than other comparable areas of scientific research, such as biotechnology. On average, Canadian and American news outlets surveyed averaged slightly more than one news item of substance on nanotechnology a month. To put that in context, a survey of thirteen Canadian newspapers in 2004 saw an average of three items per month on stem cell research (over eight items per month in the United States in twelve newspapers surveyed); and over two items on genetically-modified foods and crops in both Canada and the United States.

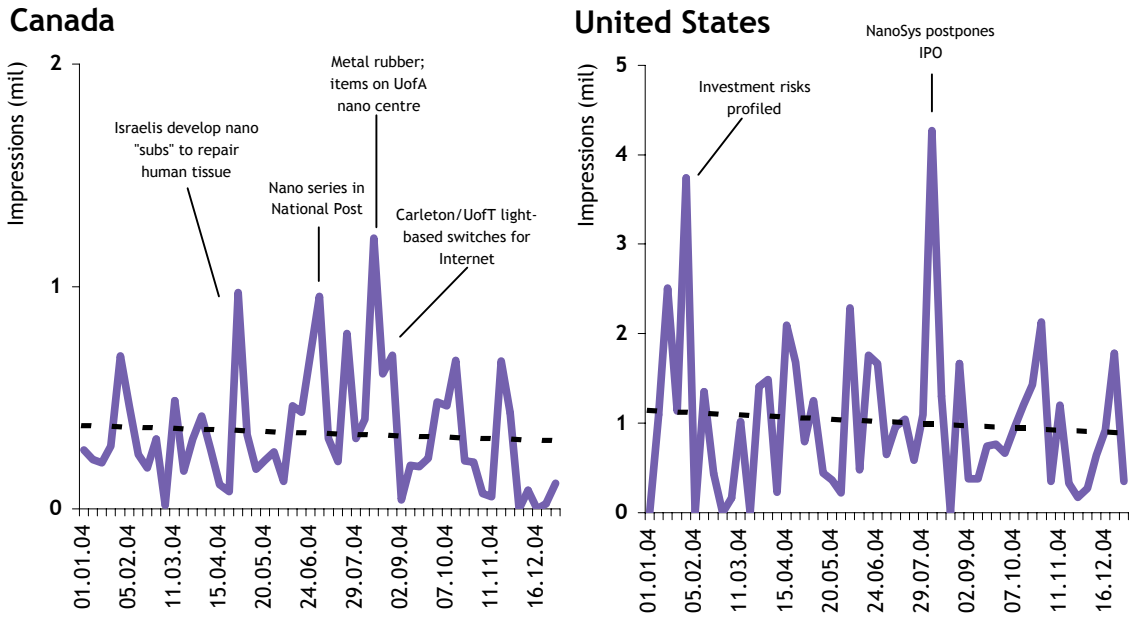
In a comparison of Canadian versus U.S. media coverage of nanotechnology, several indicators suggested that the Canadian mainstream print media provided more coverage of nanotechnology than their American counterparts. Canadian newspapers surveyed averaged 15.5 items during 2004, with a median score of 16, compared to an average of 13.3 news articles for U.S. newspapers with a median score of 12. Eight of the thirteen Canadian dailies surveyed published at least sixteen items on nanotechnology, compared to four of the twelve surveyed in the United States.

[19] Benefits associated with nanotechnology included: Health, Environmental, Defense use, IT/Communications, Economic/business, Materials/products, and Science/research. Risks or concerns associated with nanotechnology included: Health, Environmental, Security/terrorism, Moral/ethical, Investment, Legal/regulatory, Societal/cultural.

Canadian news outlets also tended to cite nanotechnology more prominently than U.S. media outlets: 51% of news items mentioning nanotechnologies in Canadian newspapers cited it prominently (nanotechnology was the main subject of the article), compared to 42% of items surveyed in the United States. Nanotechnology also triggered slightly more debate from media opinion leaders in Canada, as over 8% of the Canadian sample consisted of op-ed articles, columns, editorials or letters to the editor, compared to only 3% of the U.S. sample.

An important factor behind the higher coverage in Canada was the attention to nanotechnology by U.S. and Canadian wire-services and their pick-up among major newspapers, particularly in the CanWest chain. Items from staff writers accounted for 55% of the sample of Canadian news items, but over 90% in the U.S. papers surveyed. Canadian dailies such as the *Vancouver Sun*, the *Saskatoon Star Phoenix*, the *Calgary Herald* and the *National Post* reprinted wire items, particularly from CanWest reporters such as Margaret Munro and Sarah Staples, that resulted in above-average coverage of nanotechnology. In the U.S., while coverage was high in the *New York Times* and the *Wall Street Journal*, the only major regional paper that provided more than 16 news items was the *Boston Globe*. Many factors may have contributed to the fact that compared to Canadian outlets, U.S. media outlets picked up relatively few wire-copy stories on nanotechnology stories, but the result was that Canadian media outlets, by sharing news items and/or picking up Canadian Press and CanWest wire-copy (as well as Reuters, Associated Press and Dow Jones), tended to provide more overall media exposure to its audiences on this subject than major U.S. papers.

Figure 1: Coverage over time
Print media coverage of nanotechnology issues in Canadian and U.S. news outlets in 2004 plotted by week. Coverage measured in millions of audience impressions.



In both Canada and the United States, there was no indication that media interest in nanotechnologies was increasing. In both countries, media exposure over the course of 2004 trended downwards, with a slightly steeper decline observed in the U.S. than in Canada. Due to the relatively short twelve-month time frame, it cannot be stated with any certainty that media interest in nanotechnology is declining, but the study showed no indication of a strong interest in the area. When coverage did peak, it tended to result from profiles of scientific discoveries in Canadian outlets, while U.S. coverage peaked from business and market news pertaining to companies involved in nanotechnology.

Framing nanotechnology stories

An initial review of the coverage suggested that there existed at least six broad news frames (three major and three minor frames) in how the media presented news about nanotechnology to its readers. The three major frames, which comprised 86% of the sample, included the following:

1) **Profiling new technologies** The dominant news frame consisted of profiles of new technologies and/or research in which nanotechnology was applied for some purpose, which comprised 47% of the items surveyed. Examples of stories included the use of nanobumps in hip replacement surgery, nanoparticles used in stain resistant clothing, nanotechnology used to make 'metal rubber', nanotubes used to create a 'space elevator', and the Central Intelligence Agency's use of nanotechnology to create a new series of biosensory equipment. This news frame tended to rely on scientists and researchers involved in nanotechnology as the primary source of information, and also tended to focus on the application's benefits for an individual or for society; only 3% noted any risk with the use of nanotechnology, while 90% highlighted a specific benefit.

2) **Societal risk/benefit discussion** A second major news frame involved a broader risk/benefit discussion about nanotechnology, which accounted for 21% of the items surveyed. This category also involved researchers and experts as a key source, but would invariably balance their more favourable views of nanotech research with other stakeholders (such as bioethicists, environmental advocates) that highlighted potential risks about nanotechnology. Reports tended discuss nanotechnology broadly, giving little or no attention to specific applications. Over 54% of coverage identifying some risk associated with nanotechnology fell within this category.

3) **Business and market news** Over 18% of coverage focused on business or market news involving companies specializing in or using nanotechnology. Reports within this news frame tended to use business officials or industry analysts as the main source of information, and focused on issues such as financial and share price performance and equity market issues. Business and market news tended to provide very limited information about nanotechnology, as only 34% of total items sampled in this news frame discussed its benefits, and 27% discussed the risks associated with nanotechnology (and most cases, it was the investment risks and benefits that were discussed).

The three minor news frames, accounting for the remaining 14% of news items sampled, were: 4) **profiles of institutes or facilities** focusing on or involved in nanotechnology (8%); 5) the **economic impact** of nanotechnology investment in terms of employment and infrastructure investment for a country or region (5%), and 6) **regulatory, legal and/or patent issues** arising from nanotechnology (1%).

There was a notable difference between Canadian and U.S. media in their choice of news frames. Canadian media outlets demonstrated a much higher concentration of stories that profiled specific nanotechnology applications and research than American outlets, which tended to focus predominantly on business and market news concerning nanotechnology. As shown in Table 1 below, almost 59% of Canadian audiences exposed to a news item on nanotechnology in 2004 saw a story that fell under the first news frame profiling specific nanotechnology applications and research. Business and market news comprised only 6% of total audience reached by Canadian coverage, while economic benefits of nanotechnology accounted for less than one percent. In the United States, the business and market news frame led with 34% of total U.S. audience exposure, with economic benefits adding an additional 6%. The profile of new technologies accounted for a significant share of total audience exposure at 27%, but much less than in Canada. Items that took a broader, societal risk/benefit approach to the topic comprised 28% of total audience exposure in Canada, and slightly less (21%) in the United States.

This tendency to focus on the impact of nanotechnology on business by the U.S. media was reflected in part by where the news about nanotechnology appeared within the newspaper. In Canada, 53% of news items accounting for 47% of total audience exposure appeared in the front section of newspapers that either dealt with general news or were part of weekend feature sections, while 26% of items comprising 36% of total audience exposure appeared in the business section. In the United States, it was reversed, with 51% of items accounting for 54% of audience exposure appearing in the business sections, while the general news sections contained only 26% of total news items comprising 28% of total audience exposure. American publications tended to allocate a higher share of total exposure to lifestyle, health and science sections than Canadian newspapers surveyed, which often covered the same type of story (the news frame involving the profile of leading technologies) in the general news section. Nonetheless, it reinforced the fact that U.S. media devote proportionately more attention to business and financial news involving nanotechnology than Canadian outlets. The *Wall Street Journal* and its focus on business stories does skew U.S. media coverage, but even excluding it from the analysis undertaken above, 35% of American audiences exposed to a news item on nanotechnology would have seen either the business/market news frame (27%), or the economic benefits news frame (8%), more so than profiles of nanotechnology applications (32%). Furthermore, 47% of that audience exposure would have come from the business sections of newspapers.

Table 1: News frame by country
Percentage share of total print audience exposure of nanotechnology issues in Canadian and U.S. news outlets in 2004 by major news frame.

News Frame	Canada	U.S
Technology/research profiled	58.7%	27.4%
Business/market news	6.4%	33.8%
Risk/benefit discussion	27.8%	21.0%
Economic impact	0.4%	6.4%
Facilities/institutes	6.5%	5.6%
Regulatory/legal/patent	0.2%	5.8%
	100.0%	100.0%

Table 2: Newspaper section by country
Percentage share of total print audience exposure of nanotechnology issues in Canadian and U.S. news outlets in 2004 by section of newspaper in which item appeared.

Newspaper section	Canada	U.S
Business	36.10%	52.20%
News	47.40%	27.60%
Life/health/science/technology	4.20%	15.40%
Arts & entertainment	5.00%	2.10%
Other (community, auto, careers, etc.)	7.20%	2.70%
	100.0%	100.0%

Risk versus benefits of nanotechnology

Media coverage of nanotechnology tended to emphasize the benefits of nanotechnology to a much greater extent than the risks associated with it. Almost 71% of the news items surveyed noted at least one benefit associated with nanotechnology; conversely, only 18% of news items noted a risk. The most common benefit was associated with improvements to materials, products and

construction/manufacturing processes (34%), followed by health benefits (22%), IT/communications (18%), and science and research (13%); other benefits saw distinctly less coverage, including employment (7%), security and defense (3%), and the environment (2%). Risks associated with biotechnology tended to focus on three areas: investment (35%), broad societal or cultural (including the science fiction concept of 'grey goo' expounded in Crichton's book *Prey* - 25%) and health (19%), with other risks and/or concerns each comprising less than 6% of the sample.

Once again, there was a marked difference in what Canadian audiences were exposed to compared to American audiences in terms of news coverage portraying the benefits of nanotechnology relative to its risks. In Canada, 86% of the news reports accounting for 91% of total audience exposure expressed a benefit, compared to only 52% of the items accounting for 68% of audience exposure in the United States. Admittedly, Canadians were also exposed to more news coverage highlighting the risks of nanotechnology compared to Americans, but not to the same degree of the imbalance observed in the relative audience reach of nanotechnology's benefits. As shown in Table 3 below, 24% of total news coverage reaching American audiences expressed a risk associated with nanotechnology, only slightly lower than 33% of Canadian audiences. As a result, Canadian audiences throughout the sample period were much more likely to be read a news report highlighting a benefit of nanotechnology, and were only slightly more likely to review a report highlighting a risk.

Table 3: Risks and benefits of nanotechnology by country
Percentage share of total print audience exposure of nanotechnology in Canadian and U.S. news outlets in 2004 by whether a risk or benefit of the technology is noted.

Risks	**Canada**	**U.S**
No risks	66.9%	75.8%
Noted briefly	12.2%	12.8%
Noted prominently	20.9%	11.3%
	100.0%	100.0%

Benefits	**Canada**	**U.S**
No benefits	9.4%	31.2%
Noted briefly	35.8%	40.1%
Noted prominently	54.8%	28.7%
	100.0%	100.0%

There was less of a difference between Canadian and U.S. news outlets in the type of benefit recognized than in the amount of coverage that actually highlighted a specific benefit. Materials and products were the major benefit noted in both countries (36% in Canada, 32% in the U.S.), followed by health benefits (22% in Canada, 21% in the U.S.), and IT/communications (15% in Canada, 23% in the U.S.). The most notable difference was, again, in the U.S. focus on business and investment benefits (20% of audience exposure noting a benefit) compared to Canada, where it accounted for only

4% of total audience reach. The benefits to science and research conducted in Canada comprised 20% of total audience reach in the country, compared to only 2% in the United States. A similar business bias occurred in the examination of the type of risk associated with nanotechnology: in the United States, over 62% of the total audience that were exposed to news items highlighting a risk saw a report on the *investment* community's risk from nanotechnology – an area that accounted for only 17% of Canadian coverage addressing a nanotechnology risk. The Canadian media instead highlighted broader societal risks (34%) and health risks (33%).

Discussion

A central issue that is raised by a comparative review of media coverage in Canada and the United States is whether the public is being well served by the type of coverage they are witnessing on this issue. As Susanna Hornig Priest (2001) concludes in her analysis of the role of the media in informing the public on issues of biotechnology, the ideal is that which promotes the widest possible public debate on issues of emerging sciences; news that presents science as a *fait accompli* or that provides largely one-sided or unidirectional messaging neither promotes the science in the long-term, nor does it support democracy. Looking at the issue of nanotechnology, do the results suggest that at this early stage, Canadians or Americans are being well-served in their presentation of the science?

While the question cannot be answered definitively, the review would suggest that Canadian audiences are being much better served by the type of coverage of nanotechnology offered by Canadian newspapers than U.S. audiences. There are a higher number of news items that cover nanotechnology more prominently than U.S. outlets. More importantly, Canadian outlets are much more likely to present nanotechnology as a news story appearing in the general news sections of the newspaper, thus reaching a broader audience than U.S. outlets, that place a much higher share of coverage in the financial pages that would reach a more restricted business-oriented audience. Canadian media tend to employ a news frame that highlights the innovation of nanotechnology, explaining the science in more detail and highlighting benefits to individuals and society, while still producing a higher share of coverage that also notes the risks associated with it. Some of the biggest peaks in Canadian coverage of nanotechnology over the course of 2004 included stories about:

- How Israeli researchers developed prototypes of 'nanosubs' that can diagnose and treat cancer, drawing positive commentary from both Israeli and Canadian health researchers;
- A three day series in the *National Post* on nanotechnology in early July that included a profile of the University of Alberta's new nanotechnology centre;
- Coverage of 'metal rubber' and other nanotechnology news in mid-August; and,

- A widely-carried report on nanoscale light switches developed by University of Toronto and Carleton University researchers.

It is interesting to note that Canadian coverage has not necessarily been the result of more activity in Canada surrounding nanotechnology research. Only 28% of Canadian coverage of nanotechnology reaching domestic audiences focused on events or activities that occurred solely within Canada; one-third incorporated both Canadian and foreign sources, while coverage focusing entirely on foreign sources (overwhelmingly from the United States) accounted for 38% of audience exposure. Fully 22% of Canadian audience exposure came from foreign wire services such as Reuters, Dow Jones and Associated Press; in fact, 9% of Canadian coverage of nanotechnology was derived from AP, compared to just 2% in American papers surveyed.

The tendency of U.S. newspapers to report on nanotechnology from a decidedly business or economic news frame arguably offers the general public more meagre content in terms of understanding the broader issues surrounding the science and its benefits and risks. Even when risks and/or benefits are discussed in U.S. newspapers, they tend to highlight investment-related risks or benefits, and rely disproportionately on nanotech company executives and market analysts as sources of information. The biggest spike in terms of media coverage of nanotechnology in the U.S. in 2004 was caused by the speculation surrounding the proposed initial public offering by NanoSys that was later withdrawn by the company in mid-August. There may be a number of reasons why the U.S. news media display a bias towards business-oriented stories, but speculating on such questions go beyond the scope of this paper.

Conclusion

Certainly for the scientific community in Canada compared to the United States, the composition of media coverage of nanotechnology (if not the volume) must be viewed as a positive first step, producing an environment that highlights both the benefits of the science as well as giving a greater voice to researchers and advocates of nanotechnology. Conversely, in the U.S., audiences are provided with very little material that explains nanotechnology's benefits and/or risks to the broader public. As has been witnessed on both sides of the border over stem cell research and genetically modified foods and crops, the growing use of an advanced technology in society will eventually lead to more news media coverage, drawing an increasing number of stakeholders commenting on the issue, and raising more discussion and activity in regulating and constructing public and economic policies. Coverage offered by the Canadian media, while low in terms of volume, appears to offer a better platform from which to understand and discuss the implications of nanotechnology research and development than the current American approach.

References

Hornig Priest, S (2001). *A grain of truth: The media, the public, and biotechnology*. New York: Rowman & Littlefield.

Roco, Mihial C. and William Sims Bainbridge, eds. (2001). *Societal implications of nanoscience and nanotechnology*. NSET Workshop Report. Arlington VA: National Science Foundation.