

**PUBLIC OPINION RESEARCH FINDINGS
ON EMERGING TECHNOLOGIES**

March 2004

Report Prepared for
**Biotechnology Assistant Deputy Minister
Coordinating Committee (BACC),
Government of Canada**



POLLARA Inc. (www.pollara.com), the largest Canadian public opinion and marketing research firm, helps its clients improve their performance through strategic research designed and analyzed by consultants who are experts in their fields.

Drawing on the talents of more than 650 employees located in 6 Canadian cities, POLLARA provides a full range of research services to leading global, national and local companies and to public and non-profit sector organizations. These services include quantitative and qualitative research and counsel in the areas of public affairs/public policy, employee satisfaction, customer value/satisfaction, new product development, advertising testing and tracking, branding, and consumer demand and pricing models. POLLARA consultants use innovative, leading-edge techniques to provide clients with strategic, data-driven advice.

Table of Contents

I.	Introduction.....	1
II.	Survey Highlights	2
III.	Main Findings	6
	A. Familiarity with Emerging Technologies.....	6
	B. Support for Emerging Technologies.....	7
	C. Interest in Emerging Technologies.....	8
	D. Importance of Emerging Technologies and Applications.....	9
	E. Emerging Technologies and Canada.....	11
	F. Emerging Technologies and the Government of Canada.....	12

I. Introduction

Pollara is pleased to present this report on a public opinion research program conducted in March of 2004 for the Government of Canada's Biotechnology Assistant Deputy Minister Coordinating Committee (BACC).

This research was comprised of eight focus groups nationwide and a telephone survey of a random sample of 1000 Canadians, which yields a margin of error of 3.1%, 19 times out of 20. With that sample, sub-samples of a number of relevant audience segments were produced, including Canadians who are above-average media consumers.

The research was designed to accomplish several major objectives:

- To measure familiarity with several emerging technologies, namely biotechnology, genomics, proteomics and nanotechnology;
- To gather information on interest in and support for these emerging technologies;
- To explore attitudes towards new technologies and their applications;
- To gauge how important Canadians believe these technologies are for the future and health of Canadian economy and society; and
- To explore Canadians' preferred roles for the Government of Canada on these issues.

The data collection work began on March 19 2004, and ended on March 30, 2004.

For further information please contact:

Marie Larose at 416 921 0090
Jeff Walker at 613 2338080

II. Highlights

This research program's primary purpose was to set some benchmarks in terms of awareness, familiarity, and prevailing sentiments about some of the new areas of technology that are rapidly becoming part of our economy and our society. Some of these technologies have been with us for a period of time and BACC has gathered a sense of their perceived importance, but this project created an opportunity to situate some of the technologies that have been investigated in some detail (like biotechnology) and compared them to other fields (like genomics, proteomics, and nanotechnology).

The secondary purpose of the research was to gather feedback about preferred roles and responsibilities of government with regard to these areas. In this vein, the main purpose was to gather input about which of these areas are the ones that Canadians see as important for a government role in, and whether the main role they envision is a regulatory role, a support role, or both.

In order to provide points of comparison, we added questions about other areas like hydrogen fuel cell technology and aerospace technology, so the findings enable us to draw comparisons with areas that have had more profile and a longer period of involvement by governments.

Before being provided with a specific definition, most describe themselves as largely unfamiliar with these areas of technology, with biotechnology being the area where more people express a perceived level of familiarity. However, once described, many more suggest that they actually do have some familiarity with these fields.

Focus groups lend insight to these differences, which were often in the range of 25-30% increases in reported familiarity. What was found was that in most cases, familiarity is a function of knowledge about specific applications – a person who has heard about stem cell research realizes that the application is part of biotechnology, or a person who has heard of tiny cameras that can be swallowed and used in medical testing realizes that this is part of nanotechnology. So before they hear a definition of the term, they don't always make the link between the broad category and the specific applications they know.

Interestingly, in many cases, particularly for nanotechnology and biotechnology, much of the knowledge derives from popular culture, from science fiction books to television shows. While not part of the focus of this report, one of the main implications of this is that people tend to overestimate the scope of these technologies, and the extent to which they

have become commonplace in areas such as health care and criminal investigations.

Among the four main areas of technology that were tested in this study (biotechnology, genomics, proteomics, and nanotechnology), most people tend to see these as related fields, rather than separate fields.

The focus groups revealed that they assess these technologies in similar ways as well. In fact, what this research revealed was that people look at applications in all of these areas in identical ways, similar to how people look at most applications of biotechnology.

- The vast majority of Canadians resist offering systemic views on applications in any of these areas. They evaluate each application on its individual merits, employing a specific analytical paradigm to assess applications on a case-by-case basis.
- That paradigm is a risk/benefit calculation, with their conclusion driven by an assessment of the **marginal personal benefit** conveyed by the application. In other words: “do the potential benefits of the application (compared to products already available) outweigh the potential risks to myself or my family?” In simple terms, the larger and more personal the anticipated benefit, the more acceptable the risk and the higher the level of support for a given application.
- The most prevalent negative driver is concern about long-term risks and unknowable outcomes that these technologies may produce — in particular, potential long-term risks to human health and the environment. The more intrusive the application, the higher the life form it involves and the larger the degree to which the application crosses boundaries separating plants, animals and humans, the larger the perceived risk.
- The fact that an application has a genetic modification involved or not is less of a differentiating factor of risk among applications than might have been expected. Focus groups revealed that some nanotechnology applications that have no genetic component were believed to offer greater risks than some genetic applications.
- The most prevalent positive driver revolves around the “purpose” of the application. If the purpose of the application is deemed to be appropriately motivated and offers the ability of people to personally benefit then its perceived benefit will be greater.

There is strong evidence of support for many of the individual applications that were tested in this survey, particularly those in health and the environmental sphere. In most cases, more than 80% believe the applications will be of benefit to society,. The differences were generally unrelated to the types of technologies involved (biotechnology versus nanotechnology) per se, rather they had to do with the purpose of the various applications.

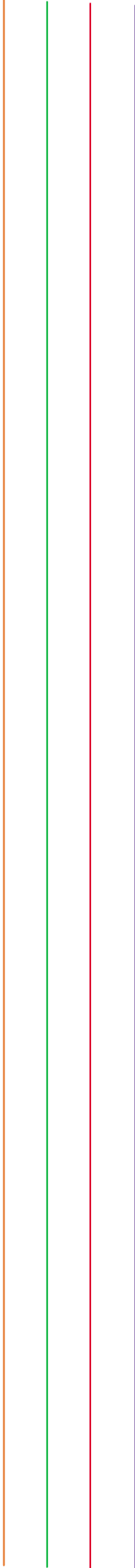
At the same time, both the survey and the focus groups indicated that there are significant concerns associated with all of these technologies, most of which revolve around health and environmental risks over the long term. In focus groups, it was clear that people needed to be given comfort that risks have been assessed thoroughly and that they be monitored over time in order for people to consent to the application being commercially acceptable.

In terms of government roles and responsibilities, the results first showed that people wish for government to play roles of both regulating these technologies and supporting them, with a slight emphasis toward regulation. In the realm of government support, people do not have a strong predilection of support for one of these new areas over the others, although they do widely acknowledge that there is a role for government in these areas.

One point worth noting is that a predisposition toward support is greater for all of these new technologies than for one that has long enjoyed significant government support – the aerospace sector. That signals that there is a significant level of support for government involvement in all of these areas.

In focus groups, respondents indicated they felt experts would be better positioned to make the actual decisions about the areas that receive greater or lesser support. They hoped experts would look closely at the individual applications involved rather than areas of technology as a whole, not only because that is how they look at these issues, but also because they feel that Canada is a country that needs to focus its energies and resources in niches of strength, as we don't have the luxury of supporting all areas.

The reason why they tend to feel this way was revealed in focus groups – people know that it takes significant investments in these fields in order to be a leader and stay ahead of the rest of the world, and they tend to believe that the only way Canadian researchers can be on a level playing field with researchers from countries that have larger economies and larger pools of venture capital is if government plays a role in trying to level the playing field.



In terms of communications, the expressed demand from government is balance – to provide Canadians with information about risks, benefits, and the roles and activities of government with regard to each of the applications that are being researched and approved in Canada.

III. Main Findings

A. Familiarity with Emerging Technologies

One of the main thrusts of this research focused around measuring familiarity with biotechnology, nanotechnology, genomics, proteomics and, to a lesser extent, hydrogen fuel cell technology.

The first set of questions about familiarity revealed that biotechnology is the most recognized of the emerging technologies tested in this survey. This was the only technology that had more than half of respondents (54%) say they were familiar (8% very familiar and 46% somewhat familiar). Almost half (46%) were familiar with hydrogen fuel cell technology (5% very and 31% somewhat), about a quarter (23%) expressed familiarity with nanotechnology (3% very and 20% somewhat), while 15% said they were familiar with genomics (2% very and 13% somewhat). Only one in twenty (5%) said at first mention that they were familiar with proteomics (1% very and 4% somewhat).

After these “cold” questions, the technologies were briefly explained, after which respondents were again asked how familiar they were with the technology. For all but biotechnology, which had quite a high level of familiarity in the first place, reported familiarity went up substantially.

Genomics was explained as “the study of genes and their functions,” with the Human Genome project given as an example. Familiarity jumped from 15% to 44% (6% very and 38% somewhat familiar).

Nanotechnology, explained as “involving the study, manipulation and manufacturing of ultra-small structures and machines made of as few as one molecule, with applications in industry, health, and the environment,” was upon clarification familiar to three in ten Canadians (30%: 4% very and 26% somewhat), up from 23% at first mention.

Proteomics, although still the most unknown of the emerging technologies, saw a significant jump. Almost a quarter, 23%, had heard of “the study of how proteins work in cells. Proteomics attempts to assess differences in protein levels between healthy and diseased cells.” As example was given research into why certain proteins are found in abnormal amounts in certain types of cancers. Three percent was very familiar and one in five (20%) somewhat familiar, up from 1% and 4%.

B. Support for Emerging Technologies

After having heard the explanation of each technology, respondents were asked whether they were generally supportive of or opposed to this particular technology.

At first glance, these data show that support is quite high for all four technologies. Support is highest for proteomics: 91% of Canadians is generally supportive. Three quarters are supportive of nanotechnology (75%) and biotechnology (76%), while 84% is supportive of nanotechnology. This suggests that Canadians tend to be more supportive of those technologies that they expressed least familiarity with.

However, when looking more closely at sub-samples of the groups of people who are generally more familiar with a technology, we see that these people tend to be more supportive than those who are less familiar.

Although this rings true for all technologies, this is most pronounced for genomics, where a 25-point difference emerges between those familiar (81% generally supportive) and those not familiar (56% generally supportive). For nanotechnology, the spread is 18%, with 92% support among those familiar and 74% support among those not familiar. Approximately the same gap is seen for biotechnology (80% support among those familiar and 64% support among those not familiar). Proteomics, which yielded low familiarity and the highest support, sees a 10-point spread, with 95% and 85% respectively being supportive.

Regionally, for the most part, this same trend is in evidence. The regions that are generally more familiar with the technologies, are also as a whole more supportive.

Atlantic Canadians and residents of the Prairies are less familiar with all four technologies, and generally express average or below average support. British Columbians and residents of the Territories are more familiar with all four technologies, and generally more supportive. Ontarians are slightly more familiar and show about average support. Quebecers follow that same trend for proteomics and nanotechnology (more familiar and more support), but break it for biotechnology and genomics. For these, although showing less than average familiarity, they however also show above average support.

Young Canadians aged 18-34 are also more likely to be more familiar and more supportive.

Men are significantly more familiar with nanotechnology (15% more familiar than women: 64% versus 49%) and also show a higher level of support (87% support versus 81% of woman). Men are also slightly more familiar with biotechnology (81% familiar versus 78% of women) and are also more supportive (79% support versus 73% of women).

Women express only slightly more familiar with genomics and proteomics, while support among this group is about equal to that of men.

C. Interest in Emerging Technologies

A majority of Canadians (58%) say they are interested in emerging technologies such as biotechnology, hydrogen fuel cell technology, nanotechnology, genomics and proteomics. A plurality of Canadians (43%) considers themselves somewhat interested, while another 15% say they are very interested. One in five (21%) are not very interested and about the same percentage (20%) are not at all interested.

Men are more likely to say they are very interested (20% versus 10% of women who say the same). Overall, 62% of men and 54% of women express some level of interest.

Regionally, Canadians west of Ontario express above average interest (62% of residents of BC/Territories and the Prairies are interested to some extent), while Quebecers, with an even split between those expressing interest and those not, are least likely to say they are interested (51%).

Urban dwellers are more familiar with and more supportive of these technologies than those residing in rural areas of the country.

Interest is strongest among the youngest cohorts within the population: where three quarters (74%) of young Canadians aged 18-34 express interest (including a full 21% expressing high levels of interest), three in five (60%) of those aged 35-54 and only 44% of those aged 55 and over say the same.

Respondents who indicated they were very interested in these emerging technologies in general were asked whether there were any specific technologies or applications they were particularly interested in. A third (33%)

said they would be interested in the area of biotechnology and genetics and 30% expressed interest in hydrogen fuel cell technology or so-called smart-cars, or energy in general. Nanotechnology was found particularly interesting by 13%, medical research by 6% and computer technology and environmental research/technology by 5% each.

While women and older Canadians express more interest in biotechnology, genetic research and medical research, men and younger Canadians are more interested in hydrogen fuel cell technology and nanotechnology.

Most Canadians, (64%), see the fields of biotechnology, proteomics, nanotechnology and nanotechnology as being related, while three in ten (28%) believe they are separate. Rural Canadians, Quebecers and residents of the Atlantic provinces are more likely to perceive them as being related.

In terms of communicating with the public on these topics, an overwhelming percentage (85%) would like to receive balanced information from government on these issues, which would give Canadians information about both benefits and risks of the technologies and their applications.

D. Importance of Emerging Technologies and Applications

Twelve specific potential applications of these emerging technologies were suggested; respondents were asked how beneficial to Canadian society they thought each of these were.

Six applications were health-related:

- The mapping of the SARS virus genetic structure, to determine its characteristics and likely originating organism;
- The mapping of the genetic structure of mice, to enable scientists to determine the genetic comparability between mice and humans, and therefore the utility of medical treatments that might be used with humans;
- A tiny wireless “lab on a chip” that can be placed into the eardrum of deaf people that will enable them to hear;

- Advanced drug “labs on a chip”, that would be placed in/on the body that would automatically monitor levels of drugs in the body and automatically administer treatments as needed;
- The development of genetically modified vaccines, such as a vaccine developed to resist the SARS or West Nile virus; and
- Helping to cure type 1 diabetes by inserting a modified gene into the pancreas that stimulates the insulin production process in humans.

All these applications garnered support from an overwhelming majority of Canadians. Those applications that suggest a direct cure are seen as most beneficial: A wireless chip to enable deaf people to hear tops the list with 92% seeing it as beneficial, followed by 88% for helping to cure type 1 diabetes. Genetically modified vaccines are seen as beneficial by 85% of Canadians and mapping SARS by 79%. Three quarters (74 and 73%, respectively) see mapping the genetic structure of mice for human medical treatment and a drug chip placed in the body to monitor and administer treatments as beneficial.

Three applications were environmental in nature:

- The use of molecules that have magnetic properties to extract heavy metals in water treatment facilities; and
- The use of light-sensitive molecules that have the ability to detect pollutants in water and air, by the amount of light they emit.
- Hydrogen fuel cell technologies, that can potentially be used as a substitute for gasoline powered engines in cars and trucks.

The two applications using molecules to assist water purification were seen as equally beneficial: Both were seen as beneficial by 83% of Canadians.

Finally, three applications were industrial in nature:

- The mapping of the genetic structure of grapes, to enable scientists to identify the genetic triggers of sugar content and other properties of grapes, for use in wine production;
- The use of “nanocatalysts” in oil sands development, which are molecules that separate the sand from the oil, that substitute for the energy intensive separation processes that are currently used; and
- Canola that has been genetically modified to resist certain diseases in order to increase the volume of canola grown.

The three industrial applications were seen as the least beneficial to Canadian society of all twelve applications tested. This could be explained by the fact that people might not directly see how these applications will benefit them personally, and an underlying unease with genetically modified foods. Majorities still see the use of nanocatalysts in oil sands development (69%) and GM canola to increase canola volume (57%) as beneficial. A quarter of Canadians however do not believe the mapping the genetic structure of grapes used in wine production is beneficial, and 12% say it's neither. This application is the only one that does not seem beneficial to a majority of Canadians: 42% say it is beneficial, compared to an almost equal group (38%) who do not see it as beneficial.

Overall, there is an overwhelming notion among Canadians that these emerging technologies and the applications, as explained to them, are a good thing for Canadian society. Regional and demographic analysis shows that for the main part, Canadians, no matter area of residence, age or gender, tend to agree on this.

E. Emerging Technologies and Canada

In order to gauge how important Canadians believe biotechnology, nanotechnology, genomics and proteomics to be for Canada, a closer look was taken at the importance of each for Canada's economy and society, particularly for health of Canadians and the environment.

Canada's Economy

All four technologies are seen as important to the future of Canada's economy, with biotechnology, the most well-known of the list, being seen as important by over four in five Canadians (83%). The hierarchy then follows the initial "familiarity" order: Three quarters (75%) believe nanotechnology is important for the economy, and 71% believe the same about genomics and proteomics.

The perceived importance of all four technologies for the future of Canada's economy declines by age, everywhere from a seven-point spread for biotechnology between those aged 18-34 and those aged 55+ (with those aged 35-54 somewhere in the middle), to a twelve-point spread for nanotechnology, with genomics at an eight-point spread and proteomics at a nine-point spread.

Regionally, some slight variations can be found. Quebecers are more likely to rate biotechnology as important, while residents of BC and the

Territories are slightly less likely to rate biotechnology and genomics as important to the economy. Atlantic Canadians are most likely to say genomics are important, while residents of BC and the Territories, their neighbours of the Prairies are also less likely to rate genomics as important.

Men are more likely to see the importance of genomics (74% saying important, versus 69% of women) and proteomics (75% versus 68%).

Canadian Society

Here, again, biotechnology tops the list of perceived importance. Fully 86% of Canadians believe biotechnology to be important to the future of Canada's society, particularly for human health and that of the environment. Genomics (78%), proteomics (76%) and nanotechnology (76%) are seen as important by about the same majorities of Canadians.

Again, the perceived importance of all four technologies for Canada's society declines by age, everywhere from a six-point spread for biotechnology between those aged 18-34 and those aged 55+ (with those aged 35-54 somewhere in the middle), to a thirteen-point spread for proteomics, with genomics at a twelve-point spread and nanotechnology at an eight-point spread.

Atlantic Canadians generally are slightly more likely to rate any of these technologies as important, while western Canadians generally tend to be slightly less likely to do so.

F. Emerging Technologies and the Government of Canada

Of these same four technologies as tested above, plus information technology (IT), aerospace technology and environmental technology, respondents were asked to indicate whether they believe it important for the Government of Canada to take steps to support it, through tax credits, granting councils, or other potential mechanisms like venture capital funds.

Most Canadians believe it is important for the Government of Canada to support all of these technologies. Environmental technologies are seen to be an important issue by 88% of Canadians, followed by 83% for biotechnology. IT (76% finding it important), nanotechnology (75%), genomics (73%) and proteomics (72%) are all very close as to how many believe it should be supported. These technologies have a core group of about 10% that believes it is not important for the Government of Canada

to gather behind it. Aerospace technology lags behind, with still a majority (62%) finding it important, but with a more significant group (21%) deeming it not important.

For most of these technologies, perceived importance declines by age.

In emerging fields like nanotechnology and proteomics, one role for the Government of Canada is to regulate the products that are being developed, to ensure that they are safe for health and environment; another role is to support the development of the industry, which helps create investment and jobs. With respect to these fields, respondents were asked to chose which role they think the Government of Canada is putting more emphasis on today, and on which role they believe it should place more emphasis.

A plurality (45%) believes that today emphasis is on both regulation and support for industry. One fifth (19%) believes emphasis is on regulation and about the same number (18%) believes emphasis is on industry.

A majority, 63%, believes the Government of Canada should place equal emphasis on both. A substantive group of a quarter of Canadians (24%) believes that regulation merits the government's focus, while one in ten (10%) believe the focus should be on industry.

Regionally, there is some disparity between those that tend to be more likely to lean towards emphasis on regulation and those that tend to lean more towards equal emphasis: while slightly less than a quarter of residents of Ontario and all provinces west of Ontario would like emphasis on regulation and more than six in ten residents of those regions would like to see equal emphasis, slightly more than a quarter of those east of Ontario would like to see emphasis on regulation and slightly less than six in ten residents of those regions would like to see equal emphasis on both.