Honesty, Accountability and Trust: Fostering Research Integrity in Canada

The Expert Panel on Research Integrity

Council of Canadian Academies
Conseil des académies canadiennes

Science Advice in the Public Interest

HONESTY, ACCOUNTABILITY AND TRUST: FOSTERING RESEARCH INTEGRITY IN CANADA

The Expert Panel on Research Integrity

THE COUNCIL OF CANADIAN ACADEMIES
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The Expert Panel on Research Integrity (the Panel) was established in response to a request from the federal Minister of Industry, who asked the Council of Canadian Academies to develop, by consulting both national and international evidence, a common understanding of *research integrity* that would be acceptable to all parties involved in the research process.

During the course of its deliberations, the Panel sought assistance from many people and organizations that provided valuable advice and information for the Panel's consideration. A full list of these invited speakers is provided in Appendix C. The Panel also wishes to express its thanks to the Canadian Research Integrity Forum, which graciously provided an opportunity to the Council of Canadian Academies staff to observe their discussions.

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Report Review

This report was reviewed in draft form by the individuals listed below – a group of reviewers selected by the Council of Canadian Academies for their diverse perspectives, areas of expertise, and broad representation of academic, industry, policy, and non-governmental organizations.

The reviewers assessed the objectivity and quality of the report. Their submissions – which will remain confidential – were considered fully by the Panel, and most of their suggestions were incorporated into the report. They were not asked to endorse the conclusions nor did they see the final draft of the report before its release. Responsibility for the final content of this report rests entirely with the authoring Panel and the Council.

The Council wishes to thank the following individuals for their review of this report:

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The report review procedure was monitored on behalf of the Council's Board and Scientific Advisory Committee by Dr. John Hepburn. The role of the report review monitor is to ensure that the Panel gives full and fair consideration to the submissions of the report reviewers. The Board of the Council authorizes public release of an expert panel report only after the report review monitor confirms that the Council's report review requirements have been satisfied. The Council thanks Dr. Hepburn for his diligent contribution as review monitor.

Elizabeth Dowdeswell, President
Council of Canadian Academies

Foreword

In June 2006, Dr. Eric Poehlman made research history. After enjoying over 20 years of admiration and respect from his peers, Dr. Poehlman was accused of falsifying and fabricating data in multiple publications and National Institute of Health grant applications, resulting in around US$1.7 million dollars in research funding. Ultimately, he pleaded guilty to a single charge of reporting false data in a funded grant application (Sox & Rennie, 2006). He was the first researcher in U.S. history to be sentenced to prison time (approximately one year of confinement, and two years of probation) for the falsification and fabrication of research data (ORI, 2005; U.S. District Court for the District of Vermont, 2005; Interlandi, 2006, October 22).

Dr. Poehlman's research focused on obesity, menopause, and aging which are topics of great interest and importance to researchers and the general public alike. Investigations carried out during the Poehlman case revealed incidences of misconduct dating back over 10 years, during which time he had fabricated data from numerous, longitudinal studies in order to support his proposed hypotheses. Dr. Poehlman's work, however, not only tested his own theories; his research and reported findings also validated generally accepted assumptions within the community. This fact, coupled with the expense and difficulty of replicating the purported studies, is one of the main reasons why he was able to continue for so long without raising suspicion, and even to develop a Canadian connection.[1]

In his statement during the sentencing trial, Dr. Poehlman accepted responsibility for his actions, yet pointed to environmental factors, such as pressures to procure grants and financially support his team, as significant influences on his conduct and decisions. Dr. Poehlman's case, while unique in its severity and expansiveness, raises issues that are increasingly garnering attention within the research community. Namely, what are the factors that give rise to such behaviour, and what can be done to minimize their occurrences? In short, how do we ensure the integrity of the research enterprise?

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[1] In 2001, Dr. Poehlman left the University of Vermont, where he was under investigation for fabrication of data, to become a faculty member at the University of Montréal. The University of Vermont cited "privacy law" as prohibiting it from disclosing information about Dr. Poehlman to the University of Montréal (Kondro, 2005).

Canada has also witnessed several high-profile cases widely discussed in the popular media.[2] As a result, in 2009, the Tri-Council[3] committed to reviewing and strengthening its framework regarding research integrity. As part of this review, the Minister of Industry asked the Council of Canadian Academies (the Council) to conduct an assessment of "key research integrity principles, procedural mechanisms and practices, appropriate in the Canadian context that could be applied across research disciplines at institutions receiving funds from federal granting councils." In response to the charge, the Council established the Expert Panel on Research Integrity (the Panel) in October 2009 to write a comprehensive, evidence-based report, using a systematic approach to gathering evidence from various disciplines.

The Panel saw its role as bringing clarity to the subject of research integrity, and decided that the strength of its messages would be best presented within a short, concise report. The Panel's key goal was to produce a text that would be relevant to researchers across all disciplines, from the natural and biomedical sciences, to engineering, to the social sciences and humanities. The Panel's comprehensive approach to research integrity encompasses values, principles, procedures, roles and responsibilities, accountability, and governance. The Panel gathered and analyzed evidence from the available literature, both national and international, including published studies and reports, stakeholder input, and expert opinion. The report also benefitted from the individual experience and wisdom of each Panel member.

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[2] See Laidlaw, 2009; Munro, 2010; Burgess, 2006.

[3] The Tri-Council refers to Canada's three federal granting agencies: the Natural Sciences and Engineering Research Council (NSERC), the Canadian Institutes of Health Research (CIHR), and the Social Sciences and Humanities Research Council (SSHRC).

Table of Contents

Executive Summary

THE CONTEXT FOR THE REPORT

In 2008, following media reports of several high-profile cases of research misconduct by researchers funded by the Natural Sciences and Engineering Research Council (NSERC), the Minister of Industry called on NSERC and the Social Sciences and Humanities Research Council (SSHRC), along with the Association of Universities and Colleges of Canada (AUCC), to review the existing policy framework for scholarly research and financial misconduct. Despite finding the Tri-Council's[4] approach to research integrity to be essentially sound, the group's report put forward several recommendations to strengthen the existing framework, including a clarification of terms, roles, and responsibilities.

THE CHARGE TO THE PANEL

In response, the Tri-Council committed to reviewing its research integrity role in consultation with the community. As part of this review, in 2009 the Minister of Industry asked the Council of Canadian Academies (the Council) to conduct an assessment of research integrity in Canada. The assessment should examine existing national and international evidence, and develop a common understanding of research integrity that would be acceptable to all parties involved in the research enterprise. Specifically, the charge to the Council asked:

> What are the key research integrity principles, procedural mechanisms, and practices, appropriate in the Canadian context, that could be applied across research disciplines at institutions receiving funds from the federal granting councils?

To address this question, the Council appointed an independent, 14-member, multidisciplinary Expert Panel (the Panel) of academics, representing both individual researchers operating under the existing framework, and senior administrators responsible for the implementation and execution of research ethics and misconduct policies.

THE APPROACH TO THE CHARGE

Although the charge focuses exclusively on institutions funded through the Tri-Council, the Panel took into consideration today's complex, multidisciplinary

[4] The Tri-Council refers to NSERC, SSHRC, and the Canadian Institutes of Health Research (CIHR).

research environment. The Panel also considered various lines of evidence: research integrity approaches by leading countries, existing policies and frameworks within Canada, scholarly literature, and testimony from relevant experts. With limited quantitative evidence available on the issues at hand, the Panel relied on its own judgment and expertise to apply its analysis of the existing material to crafting an outcome that would be innovative, yet theoretically grounded and reflective of practical concerns.

Key Findings

- Canada must address the gaps in the existing research system that are undermining the system's transparency and accountability.
- Canada needs a common, system-wide approach to research integrity that involves all actors.
- There is a need to foster a positive, values-based environment for research integrity in Canada.
- Canada needs a new entity, the Canadian Council for Research Integrity, to serve as a central educational and advisory arm on issues of research integrity.

GAPS AND NEEDS IN THE CURRENT POLICY FRAMEWORK

The Panel identified four main areas in which gaps significantly affect the transparency and accountability of the existing policy framework, thereby threatening its reliability and trustworthiness:

- System-wide approach: Canada needs a system-wide approach to research integrity that is relevant to diverse and heterogeneous academic environments, particularly across all disciplines. This new approach would apply to researchers, institutions, and funding bodies. The Panel agreed on the need for a new research integrity framework based on a clearly defined and shared set of standards and principles that all actors within the research community could follow and practice.
- Information management and research: Canada needs open sharing of information among institutions, and with the public, on all aspects of the research integrity landscape. There is also a need for research on the effectiveness of preventative and educational initiatives in promoting environmental and behavioural changes. The Panel agreed on the need for the creation of a centralized system to gather, manage, and distribute research integrity information.

- Education, training, and advice: Canada needs effective education and training materials on best practices, and up-to-date curricula and training information for all actors within the research community. Those responsible for the management of research, and its funding, must also commit to, and be supported in, their roles as mentors, training/support providers, and monitors. The Panel agreed on the need for an independent source of advice on best practices and research integrity issues.
- Privacy/transparency, conflicts of interest, and incentives: Canada needs a balance between federal and provincial privacy legislation, as well as transparency with respect to proven cases of misconduct. The Panel agreed on the need for new methods to address the inherent conflicts of interest in cases of alleged misconduct at institutions that hold investigative authority, as well as for best practices related to incentives and disincentives currently having an impact on academic researchers.

CREATING A POSITIVE RESEARCH INTEGRITY ENVIRONMENT

To create a positive research integrity environment the Panel suggested a more comprehensive, multifaceted approach which features the following characteristics:

- a system-wide approach that encompasses all disciplines;
- a common set of definitions, values, and principles that are accepted and implemented by all actors in the research enterprise;
- a fair and timely process for managing allegations of misconduct;
- a centralized mechanism for information management and research on issues related to research integrity; and
- a strong focus on proactive and preventative measures by way of education, training, and advice.

The new system-wide approach consists of three broad components that will help foster a positive research integrity environment: *promotion*, *prevention*, and *sanction*.

Promotion: Promotion involves establishing common definitions, values, and principles to guide actors in their daily conduct. The Panel proposed the following definition as the cornerstone for a positive research integrity environment:

> Research integrity is the coherent and consistent application of values and principles essential to encouraging and achieving excellence in the search for, and dissemination of, knowledge. These values include *honesty*, *fairness*, *trust*, *accountability*, and *openness*.

The Panel also identified 11 fundamental principles, each of which relates to one or more of the core values:

1. Conduct research in an honest search for knowledge. *(Honesty; Fairness; Trust; Openness)*
2. Foster an environment of research integrity, accountability, and public trust. *(Trust; Accountability)*
3. Know your level of competence and your limitations; act accordingly. *(Honesty; Trust; Accountability)*
4. Avoid conflicts of interest, or if they cannot be avoided, address them in an ethical manner. *(Trust; Accountability; Openness)*
5. Use research funds responsibly. *(Honesty; Accountability)*
6. Review the work of others with integrity. *(Fairness; Trust)*
7. Report on research in a responsible and timely fashion. *(Trust; Openness)*
8. Treat data with scholarly rigour. *(Honesty; Accountability)*
9. Treat everyone involved with research fairly and with respect. *(Fairness; Trust)*
10. Acknowledge all contributors and contributions in research. *(Fairness; Accountability; Openness)*
11. Engage in the responsible training of researchers. *(Fairness; Trust)*

Prevention: Prevention provides a means of developing best practices with respect to promotion, education, and mentoring. It also offers ways of checking the effectiveness of those programs, the ultimate goals of which are to encourage research that reflects the highest standards of integrity, and to discourage undesirable practices. The Panel concluded that the overall lack of accessibility to, or availability of, information on existing research integrity policies and educational/mentoring practices has hindered the development of best practices. This, in turn, has limited the implementation of effective prevention approaches. Thus, the development and implementation of these approaches would require the commitment of all actors to engage in open and ongoing information sharing and dialogue surrounding issues of promotion, education, and mentoring. This proactive approach to research integrity would foster a positive environment of awareness, and serve as a preventative measure against egregious behaviours.

Sanction: Sanction ensures that mechanisms are in place to address misconduct cases that occur. Measures must be taken to establish timely and open due diligence protocols to maintain peer, stakeholder, and public trust in the research community's practices and products. The Panel proposed the following broad definition of research misconduct:

Research misconduct is the failure to apply, in a coherent and consistent manner, the values and principles essential to encouraging and achieving excellence in the search for knowledge. These values include *honesty*, *fairness*, *trust*, *accountability*, and *openness*.

CONSIDERING THE OPTIONS

In determining the most effective way to implement its comprehensive approach to research integrity, the Panel considered a variety of possible approaches. The Panel then narrowed these down to the three main options that are presented briefly below.

Creation of a new legislated body. A legislated body responsible for sanctioning would likely be hindered in its capacity to also effectively carry out the functions of promotion and prevention. Given the scarcity of information on best practices and efficacy, it would be difficult for policy-makers to devise an effective form of legislation. Since legislation tends to be time consuming and sometimes rigid, such a body might not be sufficiently flexible to adapt and modify its approach, as new information and research are collected in the coming years.

Increasing the Tri-Council's educational and advisory role. There was limited evidence to suggest that increasing the Tri-Council's educational and advisory role would produce effective outcomes. Its broad mandate and limited resources, in conjunction with its role in monitoring compliance, would constrain the Tri-Council from serving as an independent advisory body on issues of research integrity.

Introduction of a new actor. The gaps and lack of cohesive force in the existing Canadian policy framework suggest that the formation of a new (non-legislated) independent actor would be required to implement the first two components, promotion and prevention, of a comprehensive, system-based approach to research integrity. Endowing this new entity with an important advisory and educational role would also serve to enhance transparency and accountability.

The Panel concluded that the third option, the formation of a new central body, would best help address the gaps while, at the same time, conserve areas where the current framework is already effective. The proposed new actor, the Canadian Council for Research Integrity (CCRI), would not assume responsibility for the third component of the system-based approach, sanction. That would remain firmly within the Tri-Council's purview, given its existing position within the research

landscape and its capacity to impose penalties (e.g., withdrawal/withholding of research funds). Measures must be taken, however, to better manage institutional conflicts of interest, to ensure timely and open due diligence protocols with regard to research misconduct, and to implement methods for dealing with research partners outside of their traditional mandate.

THE CCRI

Along with the responsibility for implementing promotion and prevention, the CCRI's other key roles would include (i) the provision of confidential advice; (ii) information gathering; (iii) the dissemination and reporting of information; and (iv) the development and promotion of best practice standards with respect to education, training, and effective self-assessment policies and practices.

The CCRI would be set up as an independent, non-adversarial body to assist all members of the research community. Since the CCRI would not be involved in sanctioning or enforcement, it should be seen as a trusted entity to which individuals and institutions could turn for advice, without fearing consequences to themselves or to others.

The CCRI's core staff would report to a knowledgeable and impartial Advisory Board that would include representatives from all involved parties (i.e., academic community, government representatives, private-sector funders (non-profit foundations/industry), and members of the public at large). Any source of funding would have advantages and disadvantages, and establishing a transparent, accountable system will be integral to the effective functioning of the CCRI. Recognizing the leadership role that the Tri-Council plays in addressing research integrity at the national level, the Government of Canada could provide new funding for the not-for-profit entity via the federal granting agencies. An arm's length agreement would help ensure accountability and public trust.

A CONCERTED APPROACH TO RESEARCH INTEGRITY

The Panel's findings and conclusions reflect the emerging belief that the ethical conduct of research requires a concerted effort on the part of all actors in the research community, rather than simply a focus on individual behaviours and institutional responses. Researchers, managers, and funders must commit to a common definition and a shared set of values and principles that would foster a positive research integrity environment throughout the country. Supported and facilitated by the CCRI, the research community would then be able to manifest the highest ethical standards and, consequently, ensure public confidence in the research enterprise.

Chapter 1 Introduction and Charge to the Panel

Research in all disciplines has played, and continues to play, a key role in shaping the world in which we live. Current academic research seeks to better understand some of today's most pressing and complex issues (e.g., prevention of disease, homelessness, globalization, infrastructure, energy, cultural diversity, biodiversity, human rights, literacy, educational assessment strategies, climate change and sustainable economic development). Canada's ongoing public investments in research, at a time in which there are many competing priorities for government funding, highlight its continued importance to our economic development and well-being. The benefits of the research enterprise,[5] regardless of the discipline and however defined, are based on the assumption that the knowledge generated is accurate and trustworthy.

1.1 THE CHANGING NATURE OF RESEARCH AND CHALLENGES TO RESEARCH INTEGRITY

As the research landscape rapidly evolves, both external and internal pressures are introducing potential sources of conflicts of interest that are resulting in unexpected challenges to research integrity.

The increasingly international and interdisciplinary nature of the research enterprise has created many opportunities (Glanzel, 2001; Wuchty, Jones & Uzzi, 2007; Jones, Wichty & Uzzi, 2008). These opportunities are accompanied by a variety of challenges including how to strengthen the principles and standards governing the conduct of research when researchers across disciplines and around the globe do not necessarily share the same paradigms, cultures, and values.

In an economic climate of increased competition for funding, new potential conflicts have arisen with the expansion of the role of non-governmental sources of support (Campbell *et al.*, 2007; AUCC, 2008; Martinson, Crain, Anderson & de Vries, 2009). It has become more difficult to impose a universal set of research integrity practices in an environment that features more complex research partnerships and a greater number of researchers who procure funds from both public and private sources (Grinnell, 2005). Recent initiatives, for example, have required recipients of government funding to obtain matching funds from private partners (NSERC, 2009). Furthermore, increasing political pressure for grants, in support of team-based, applied, action-oriented, commercializable and

[5] The research enterprise refers to the systematic, purposeful engagement in knowledge creation.

translational[6] research, is creating more competition for fewer resources; this may exclude many scholars from working on more discovery-oriented projects.

Internal factors can also potentially undermine integrity standards (e.g., research output often determines institutional and professional reputations). These factors have been associated with conduct that can compromise the integrity of research, research funding, and research administration (de Vries, Anderson & Martinson, 2006; Martinson *et al.*, 2009; Fanelli, 2010).[7]

Although the majority of research misconduct cases that have received national and international media attention have centred on biomedical research areas, Gibelman and Gelman (2005) suggested that the environmental factors leading to these situations are prevalent across all disciplines. Indeed, factors such as increased competition for funding and positions, and the growing pressures to publish in order to win such competition pose the same challenges across many disciplines. Evidence suggests that these factors have similar negative consequences on the quality of research (Fanelli, 2009; Fanelli, 2010).

1.2 A SYSTEM-WIDE CHALLENGE

The challenges and pressures present within today's research environment affect individual researchers and all aspects of the research enterprise. Institutional leaders, for example, face an inherent conflict of interest in the event of a research misconduct allegation since the reputation and productivity of an institution rely on the outputs generated by its individual researchers. Thus, the pursuit of an allegation relies heavily on a manager placing the immediate "best interests" of the institution on hold, in the interest of upholding its commitment to relevant integrity standards.

Funders also face their own unique pressures. Funders, such as the Tri-Council,[8] must ensure their own independence and the integrity of their funding decisions while simultaneously responding to political pressures and persuading government

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[6] As many discoveries are not effective in terms of implementation, translational research is the conduct of research from a discovery-based to an implementation-based approach.

[7] These examples are provided as context for the report. They are offered as illustrations of the changing research environment and are not meant to represent an exhaustive list of existing and/or emerging challenges to research integrity. It was not the mandate of the Panel to provide a detailed analysis of each of these challenges. It should be noted, however, that the Panel's deliberations and ultimate findings have considered the issues raised in this section of the report.

[8] The Tri-Council refers to Canada's three federal granting agencies: the Natural Sciences and Engineering Research Council (NSERC), the Canadian Institutes of Health Research (CIHR), and the Social Sciences and Humanities Research Council (SSHRC).

to maintain and augment research funding. Private-sector and government funders, however, need to see results that justify their allocations for research. Consequently, challenges to research integrity can arise from partnerships between government departments and agencies, or among private-sector firms, community agencies, and university researchers. For example, an institution's research principles may not align with its research sponsor's privacy and production expectations. This potential conflict may result in limited public disclosure of research findings.

The examples above, although not exhaustive, illustrate the system-wide challenge faced by all actors[9] in the Canadian research enterprise. They also suggest that all actors have an important role to play in ensuring research integrity.

1.3 THE PREVALENCE OF RESEARCH MISCONDUCT

Efforts geared towards characterizing the trends in research misconduct are still in the early stages in most countries. The United States has the most structured ongoing and systematic approach to quantifying recorded cases of misconduct, which is managed by the Office of Research Integrity (ORI)[10] (ORI, 2009a). ORI's 2008 annual report listed 35 active cases at the end of the calendar year, with an equal number of new and old cases (n = 17) activated/closed during this same period. Of the 17 closed cases, 76 per cent resulted in a finding of research misconduct. Overall, the number of allegations received by ORI in 2007-08 was lower than the 2004-06 average, yet still above that of 1992-2007 (ORI, 2009b).

Survey-based evidence, however, suggests that ORI's official figures may dramatically undercount the true incidences of misconduct in the United States because most cases are never reported to institutional or federal authorities (Titus, Wells & Rhoades, 2008). Indeed, data from anonymous surveys asking scientists whether they have ever committed or observed scientific misconduct consistently suggest higher frequencies. A systematic review and meta-analysis of 21 surveys,

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[9] In the context of this report the term "actors" refers not only to those who are actively engaged in the conduct of research, but also those responsible for the management and support of the research enterprise: individual researchers, academic institutions, the Tri-Council, other public-sector funders, and private-sector funders.

[10] The ORI describes itself as "a component of the Office of Public Health and Science (OPHS) in the Office of the Secretary (OS) within the Department of Health and Human Services (HHS). [Its mission focuses on] (1) Oversight of institutional handling of research misconduct allegations involving research, research training, or related research activities supported by the Public Health Service (PHS); (2) Education in the responsible conduct of research (RCR); (3) Prevention of research misconduct; and (4) Compliance with the PHS Policies on Research Misconduct, 42 C.F.R. Part 93 ("the PHS regulations"). The Office is composed of the Division of Investigative Oversight (DIO) and the Division of Education and Integrity (DEI)" (ORI, 2008).

which were conducted mostly, but not exclusively, in the United States and covered a variety of disciplines including economics and statistics, showed that on average, approximately two per cent (1.97%, n = 7, 95% Confidence Interval = 0.86-4.45) of researchers admitted to having fabricated, falsified, or modified data to improve the outcome at least once in the past. Up to one-third (33.7 per cent) admitted other questionable research practices (Fanelli, 2009, p. e7538), including failing to present data that contradict one's own previous research and dropping observations or data points from analyses based on an instinct that they were inaccurate. In surveys asking whether such behaviours had been observed among colleagues, about 14 per cent (14.12%, n = 12, 95% Confidence Interval = 9.91-19.72) had observed fabrication, falsification, or alteration of results, and up to 72 per cent had observed other questionable research practices (Fanelli, 2009).

As in most countries, few empirical data exist in Canada on the prevalence, nature, and causes of research misconduct. Very little Canadian research has focused directly on research integrity or misconduct. Cossette (2004) reported "on the perceptions of research integrity held by administrative science faculty members in French-language universities in Quebec" (p. 213). The study did not intend to measure actual conduct, but rather focused on perceptions and opinions of the target group on aspects of research misconduct. The study probed the perceived "seriousness and frequency of various types of conduct generally associated with a lack of integrity," the causes of such misconduct, and the solutions to it (p. 213). Respondents to the survey considered the types of misconduct studied to be moderately frequent and moderately to very reprehensible. Causes were "closely linked to the achievement of professional success," and respondents favoured "solutions related to the promotion of publication quality instead of quantity, and to the inclusion of at least one full session on research integrity in advanced programs" (Cossette, 2004, p. 213; Baerlocher, O'Brien, Newton, Gautam, & Noble, 2010). While other studies have focused, almost exclusively, on the natural and health sciences, additional research is needed in all disciplines, and particularly in the arts, humanities, and social sciences.

The federal granting agencies, commonly referred to as the Tri-Council, have recently started publishing data on allegations of non-compliance with their research policies. The websites of the three granting agencies feature reports on allegations involving non-compliance with research policies (NSERC, 2010; SSHRC, 2010; CIHR, 2010a). The NSERC and SSHRC reports use the same format, while the CIHR report covers a different time period and delineates allegations in a different form. Table 1.1 summarizes the three reports.

Table 1.1
Allegations of Non-Compliance

		NSERC 2006-07 to 2009-10	SSHRC 2006-07 to 2009-10	CIHR 2000-01 to 2009-10
1	Number of Allegations	69	7	84**
2	Allegations Not Pursued	40	1	25
3	Allegations Pursued:	29	6	58
4	TCPS-Integrity	15	4	***
5	Other*	14	2	***
6	Misconduct Found	6	1	31
7	No Misconduct	17	4	23
8	Pending	6	1	4

(NSERC, 2010; SSHRC, 2010; CIHR, 2010a)

* These allegations relate to factors associated with the *Memorandum of Understanding (MOU) on the Roles and Responsibilities in the Management of Federal Grants and Awards* and other NSERC and SSHRC policies, such as lack of adherence to application guidelines (e.g., lack of adherence to the *Tri-Agency Financial Administration Guide*).

** Includes one case still pending at CIHR and thus not assigned to lines 2 or 3.

*** CIHR gives the breakdown of allegations in a different form than SSHRC and NSERC: of the 84 allegations received, 51 were related to the *Tri-Council Policy Statement on Integrity in Research and Scholarship* (TCPS-IRS); 12 to the *Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans*; 13 to other Tri-Council policies; and 8 were outside the mandate of the CIHR Research Integrity Committee.

NSERC notes that of the allegations received in 2009-10, nine were formally registered by the same complainant against one individual (NSERC, 2010). Line 2 of Table 1.1 shows that many allegations are not pursued. The NSERC, SSHRC, and CIHR websites list the reasons for not pursuing allegations: the allegation was not within the purview of the Tri-Council, or was withdrawn; the information presented was insufficient; the policies were misinterpreted (i.e., NSERC); the source of the allegation was anonymous (i.e., SSHRC and CIHR); or there was an unreasonable delay between the alleged misconduct and the receipt of the allegation. The allegations pursued are divided between those related to the *Tri-Council Policy Statement on Integrity in Research and Scholarship* (line 4) and *Other* (line 5). There are three outcomes shown: misconduct was found (line 6); the case was deemed unfounded and there was no misconduct (line 7); and files were still pending (line 8) (SSHRC, 2010; NSERC, 2010; CIHR, 2010a).

As mentioned, CIHR's report on allegations is in a different format from those of NSERC and SSHRC, and covers the period 2000-01 to 2009-10. During that time, CIHR received 84 allegations, of which 25 were not pursued for the reasons given above. Of the remaining 59 allegations, one is pending review by CIHR's Research Integrity Committee (RIC); and 58 were referred to the institutions for investigation or more information. Of these 58, the institutions found 31 to involve misconduct; 23 were not sustained; and four are pending (CIHR, 2010a).

NSERC provides a list of the specific penalties assigned for its six cases where misconduct was confirmed:

- Two students were declared ineligible to apply for and hold NSERC funding for a period of three years.
- One student was declared ineligible to apply for and hold NSERC funding for a period of two years.
- In the case of another student, NSERC found that the institution's actions were sufficient, and no further action by NSERC was warranted.
- One researcher was declared ineligible indefinitely to apply for and hold NSERC funding, and to participate in the peer review process and all other NSERC committees.
- In the case of another researcher, NSERC found that the institution's actions were sufficient, and no further action by NSERC was warranted.
- One researcher was declared ineligible to apply for and hold NSERC funding, and to participate in the peer review process and all other NSERC committees for a period of three years (NSERC, 2010).

The Panel notes that SSHRC and CIHR might wish to consider a similar public listing of actual penalties assigned.

The Tri-Council numbers represent the only publicly available, and consistently reported, data on research misconduct in Canada. Although this initiative is a good starting point for assessing the pervasiveness of this issue, it is limited in scope and provides an incomplete picture. Issues falling outside of the mandate of the Tri-Council remain unreported, as do outcomes of institutional investigations where none of the three granting agencies are involved in the allegation process.

The variation among research misconduct definitions, not only between countries, but within them as well, presents an additional challenge to monitoring and reporting misconduct cases. Although it is relatively easy to define conduct such as the fabrication of data or the plagiarism of entire texts as clearly unethical, other forms of misconduct require case-by-case assessment, interpretation, and action (e.g., from the inappropriate manipulation of statistical data to the

non-disclosure of, or failure to ethically manage, conflicts of interest; from the misrepresentation of credentials to the delaying of responses to allegations of misconduct). While these examples are more difficult to identify and address, they can be just as damaging to the research enterprise as the more self-evident cases because of their likely greater prevalence, and their undermining of the integrity and trustworthiness of the system as a whole.

Given the limited availability of data, it is difficult to accurately estimate the frequency of research misconduct in Canada and to know whether it is increasing or decreasing. International efforts to understand the prevalence of, and trends in research misconduct, particularly in the fields of biomedical and behavioural sciences, have contradicted the assumption that misconduct within the research community is relatively rare. As a result, there is increasing support in the academic community for renewed effort to ensure research integrity (Steneck, 2006; Titus *et al*., 2008).

1.4 THE CONTEXT FOR THE REPORT

Within Canada, the vast majority of research occurs within publicly funded institutions supported, to a large extent, by the Tri-Council. Since the mid-1990s, the Tri-Council has provided policy coordination and leadership in the area of research integrity. A specific Schedule of the Memorandum of Understanding between the Tri-Council and eligible institutions sets out the roles of each party in governing research integrity (NSERC, CIHR, & SSHRC, 2008). To be eligible for funding, an institution must have in place a policy for research integrity and misconduct that complies with the principles and guidelines set out in the *Tri-Council Policy Statement on Integrity in Research and Scholarship* (TCPS-IRS) (NSERC, CIHR, & SSHRC, 2009a).

While the TCPS-IRS has jurisdiction over nearly all publicly funded academic research in Canada, private-sector research is generally outside its reach, as is research conducted within science-based government departments, agencies, and councils. These departments, agencies, and councils, however, have generally considered the TCPS-IRS as the *de facto* Canadian standard in the development of their own research integrity policies (HAL, 2009). In 2006, with the support of Health Canada, the Canadian Research Integrity Forum[11] (CRIF) was established to bring together government and non-governmental organizations that share a common interest in strengthening research integrity in Canada (see Appendix A).

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[11] Formerly known as the Canadian Research Integrity Committee.

In May 2008, following media reports of falsified and plagiarized data and misuse of funds by NSERC-funded researchers, the federal Minister of Industry asked NSERC, SSHRC, and the Association of Universities and Colleges of Canada (AUCC) to review the existing policy framework for scholarly research and financial misconduct (NSERC, CIHR, & SSHRC, 2010). A working group, composed entirely of members of these three bodies, carried out this review from June to September 2008, and provided recommendations for strengthening and enforcing research integrity standards. Since CIHR reports to Parliament through the Minister of Health, it did not participate directly in this review, although it was consulted and given the opportunity to review and comment on the working group's draft report. The review was specifically charged with evaluating the adequacy of current research integrity policies, the efficacy of their implementation, levels of transparency, and financial accountability. The presidents of NSERC, SSHRC, and AUCC delivered the report's recommendations to the Minister of Industry.

The report, a *Review of NSERC's and SSHRC's Policy Framework for Research Integrity*, made public in October 2009, concluded that the agencies' overall approach to research integrity was essentially sound (NSERC, SSHRC, & AUCC, 2008). The report deemed existing policies, their implementation, and their level of transparency as appropriate, flexible, and cost effective. It suggested four areas, however, in which the agencies' framework could be strengthened:

- examination of the roles, responsibilities, and authorities of the agencies. These agencies should examine whether they fulfill their responsibilities, and whether their current legislated roles, responsibilities, and authorities are adequate;
- long-term strengthening of current research and scholarly integrity policies, including clarification of terms, roles, and responsibilities (including the revision and consolidation of existing policy documents in consultation with institutions and other involved parties);
- improvement of the effectiveness of policy implementation and increased transparency; and
- updating and strengthening of financial policies to ensure maximum accountability and provide increased clarity of terms, roles, and responsibilities. This is a long-term (up to three years) initiative that requires the participation of CIHR, the institutions, and other parties (NSERC, SSHRC, & AUCC, 2008).

Appendix B details the specifics and recommended actions for each of these four areas.

In response, the Tri-Council committed to reviewing its research integrity role in consultation with the community, while taking into consideration the following:

- the results of an independent report by the Council of Canadian Academies on key research integrity principles, procedural mechanisms, and practices (this report);
- the results of a CRIF-sponsored report on the state of research integrity and misconduct policies in Canada;[12] and
- advice from the Research Integrity Advisory Group, a committee to be established by the Tri-Council later in 2010.

1.5 THE CHARGE TO THE PANEL

In 2009, the Minister of Industry asked the Council of Canadian Academies (the Council) to conduct an assessment of research integrity in Canada that addressed the following charge:

> What are the key research integrity principles, procedural mechanisms, and practices, appropriate in the Canadian context, that could be applied across research disciplines at institutions receiving funds from the federal granting councils?

The assessment should examine the existing evidence, both international and national, and develop a common understanding of the term research integrity that would be acceptable to all involved parties in the research enterprise. These parties include (i) those responsible for the conduct of research (e.g., individual researchers, students, institutional leaders, and funding bodies); and (ii) those who are interested in research and use its results (e.g., public policy-makers, businesses, interest groups, the media, and the general public). The Minister's charge included five further sub-questions:

1. *What definitions do research institutions (i.e., post-secondary institutions receiving funding from the granting councils) employ for research integrity in Canada and how could these approaches be made more uniform?*
2. *How would the Canadian definition differ from that of other countries, including the United States and why? How do we align the approach used for research integrity, by the granting councils and the Canadian post-secondary institutions, with that of leading countries and emerging global standards?*

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[12] CRIF members sponsored a survey of Canadian and international policies and practices related to research integrity. The report received from consulting firm Hickling Arthurs Low was released in October 2009. The primary author of this report (T. Creutzberg) also made a presentation to the Panel.

3. *What actions would be considered to constitute research misconduct in a Canadian context?*
4. *In light of a clear definition of research integrity, what are the roles and responsibilities of those involved in research (including researchers, scientists and research and academic institutions funded by Canada's granting councils) to uphold this definition and the key principles and practices, including roles and responsibilities for education?*
5. *How could a common research integrity definition foster a research culture of high ethical standards and instil public confidence?*

To address these issues, the Council appointed the Expert Panel on Research Integrity (the Panel) in October 2009, with the objective of preparing a comprehensive, evidence-based report on research integrity as it applies to institutions funded by the Tri-Council. The 14 members of the research community who make up the Panel represent senior administrators responsible for the implementation and execution of research ethics and misconduct policies, as well as individual researchers operating under the existing framework. The composition of the Panel reflects the Council's careful attention to balancing disciplinary perspectives, in recognition of the fact that research integrity covers all research, and not simply the more traditionally emphasized areas (e.g., biomedical sciences).

1.6 APPROACH AND STRUCTURE

In undertaking this assessment, the Panel considered evidence pertaining to all disciplines, including natural sciences and engineering, health sciences, social sciences, and the humanities and consulted the following sources of evidence:

- research integrity approaches used around the world;
- existing policies and frameworks already in place in Canada;[13]
- scholarly literature;
- testimony from relevant experts;[14] and
- panel members' professional experience and expertise.

[13] A bibliography, including the full list of source materials consulted during the course of this assessment, is available electronically on the Council's website (www.scienceadvice.ca).

[14] See Appendix C for a list of stakeholders invited to address the Panel.

By examining existing reviews and policies of national and international systems, the Panel identified (i) the various components of an effective research integrity framework; and (ii) the strengths, weaknesses, gaps, benefits, and limitations of the existing Canadian system. The Panel found very little qualitative or quantitative evidence, however, to ascertain objectively the most effective system for the Canadian context. Although the study of research integrity and scholarly misconduct, both empirical and theoretical, is rapidly expanding, it is still relatively new. A broad and significant amount of pertinent theory and evidence, however, has been produced in other fields, such as organizational behaviour, criminology, educational theory, social psychology, and related disciplines (Thompson, 1967; Agnew, 1992; IOM and NRC Committee on Assessing Integrity in Research Environments, 2002; Tyler & Blader, 2003; Preckel, Känel, Kudielka, & Fischer, 2005).

In practical terms, the implementation and development of national and institutional research integrity approaches is ongoing, with many efforts in early stages of development. Nonetheless, the Panel examined the existing relevant scholarly literature to identify effective approaches to promoting research integrity. Using this information, the input of key stakeholders, and the professional experience and expertise of its individual members, the Panel defined the key components of a research integrity framework, and the various roles and responsibilities of the five key actors (i.e., individual researchers, academic institutions, the Tri-Council, other public-sector funders, and private-sector funders). This, in turn, led to the Panel's final conclusions on developing the procedural mechanisms to construct the most effective research integrity system for Canada.

Although this report considers research integrity primarily from the perspective of Tri-Council funding, it does so in the context of today's complex research and funding environment. Although particular research ethics issues, such as the protection of human research subjects, animal care, and research safety, fall under the research integrity umbrella (and the Panel's findings), this report reflects principally on the broader ethical foundations of an explicitly stated environment of research integrity. Finally, the Panel is sensitive to the distinction between quantitative and qualitative research. While the methodologies and expectations surrounding a quantitative, laboratory-based chemistry experiment may be far removed from a qualitative ethnographic study, the Panel's conclusions on research integrity are applicable to academic research in all its dimensions.

The principal aim of this report is to provide an analysis of existing research integrity principles and approaches. The Panel's mandate was not to conduct new or original research in this area. The Panel conducted its deliberations with an eye towards providing policy-relevant and evidence-based conclusions.

The report is organized as follows:

- Chapter 2 presents a detailed review and analysis of current approaches to research integrity from around the world and within Canada. It goes on to identify four main gaps in the existing Canadian research integrity environment.
- Chapter 3 builds on the analysis from Chapter 2 to develop the three key elements of a positive research integrity environment: a common definition of research integrity, a shared set of common values, and a shared set of fundamental principles. The implementation of these elements requires the establishment of three key components: promotion, prevention, and sanction. The chapter concludes by identifying the need for a new actor in the Canadian landscape.
- Chapter 4 outlines the Panel's proposal for the creation of the Canadian Council for Research Integrity, including considerations regarding its function and form.
- Chapter 5 sets out the breakdown of roles and responsibilities of each of the main actors within the Canadian research enterprise.

The report concludes with a discussion of what is needed to implement the Panel's vision for a values-based, Canadian research integrity system.

Chapter 2 An Examination of Existing Approaches to Research Integrity

The charge tasked the Panel with determining the optimal approach to research integrity in Canada by considering the existing national and international landscapes, including international definitions and systems. It also asked how the existing approaches to research integrity used by the Canadian granting agencies and post-secondary institutions align with each other, as well as with those of leading countries and emerging global standards (sub-questions 1 and 2).

This chapter summarizes the Panel's review of the following:

- international approaches, definitions, and systems;
- policies and frameworks used at institutions across Canada; and
- scholarly literature.

The chapter concludes with an overall analysis of the existing Canadian framework, including a discussion of the key gaps that are affecting its transparency and accountability.

2.1 INTERNATIONAL APPROACHES

The recent report delivered by Hickling Arthurs Low (HAL) to the Canadian Research Integrity Forum (HAL, 2009) categorized international research integrity governance systems into three types, according to institutional character:

- *Type I* consists of nationally legislated, centralized systems with investigatory powers.
- *Type II* consists of non-legislated bodies that defer to granting agencies or individual institutions for oversight.
- *Type III* consists of systems that lack an independent research integrity oversight body or compliance mechanism.

The construction of these "types" was likely intended to order varying national models into a manageable set of general approaches. Unfortunately, the process of generalization obscures individual differences, and elevates legislative status to the level of a definitive and distinguishing characteristic.

Each system, including those of the same type, features different divisions of responsibilities across institutional bodies of often similar, but not identical, character and mandate. Comparisons between these approaches require sensitivity to their differing mandates and settings. A committee legislatively tasked with policing research misconduct will operate with legislatively grounded powers

and terms of reference, rendering it less flexible and less easily amended to meet changing circumstances and evolving research environments than systems with established granting agencies (e.g., the Tri-Council). What all three system types have in common, however, is a recognition of the importance of both promoting positive values and deterring research misconduct.

Table 2.1 presents an overview of the Panel's review of 26 national systems from around the world. The Panel's review also drew on information from the HAL report (2009), a European Science Foundation report (ESF, 2008), and independent source material (see Appendix D for a detailed list of information sources for each country).

Nationally Legislated, Centralized Systems

Countries with legislated systems, such as the United States, Norway, and Croatia, have established a central body to focus on a narrowly defined notion of research misconduct, best suited to juridical investigations. The precise structure of these bodies differs: the Norwegian National Commission for the Investigation of Scientific Misconduct (NCISE) and the Croatian National Committee for Ethics in Science and Higher Education (CESHE) were created directly by legislative fiat; the U.S. oversight bodies, the Office of Research Integrity (ORI) and the Office of the Inspector General (OIG), are located within two national government bodies, both of which hold grant-making powers (i.e., the Department of Health and Human Services (DHHS) and the National Science Foundation (NSF), respectively). All of these bodies are responsible for investigating and reporting on research misconduct, usually by responding to cases brought to them by third parties. They are also empowered to initiate their own investigations. In all cases, although the pursuit of misconduct is only one aspect of the national research integrity system, it tends to be the most legalistically defined.

In the United States, the National Institutes of Health (NIH) and the NSF play an important role in promoting good research practices through presentations, reports, and direct advice; the ORI offers financial support to learned societies for workshops and conferences on research integrity issues, and maintains an extensive online resource centre. In Norway, the NCISE focuses exclusively on misconduct issues, but exists alongside other legislated bodies responsible for promoting responsible research conduct. In Croatia, the CESHE is also charged with promulgating research ethics and integrity; it has issued a national Ethics Code, and helped develop guidelines to this end. In all three countries, the national body handles investigations directly, while the responsibility to deploy and implement guiding principles and resources for fostering an ethical research environment falls to the individual institutions.

Table 2.1

International Comparison of Research Integrity Initiatives

	Independent Legislated Misconduct Body (investigation powers)	Legislated Misconduct Body in Granting Agency	Considering Legislated Misconduct Body	Legislated Independent Conduct Promotion Body	Conduct Promotion/ Misconduct in Same Body	No Conduct Promotion Body	Non-Legislated/ Granting Agencies - Principles & Misconduct	Proposed Policy through Granting Agencies	Non-Legislative National Advisory Body Principles & Misconduct	Non-Legislative National Academy Principles & Misconduct	Body Hears Cases/ Appeal (scope and condition vary)	Independent Advisory Body	Principles Only - No Misconduct Mechanisms	No Central Body - National Code	No Central Body or National Code
Australia														X	
Austria			X				X								
CANADA							X	X							
Croatia	X				X										
Czech Republic										X	X				
Denmark	X					X									
Estonia													X		
Finland									X		X				
France *															X
Germany							X					X			
Hungary								X							
Ireland **															X
Japan ***															X
Latvia													X		
Lithuania			X												
Netherlands			X						X		X				
Norway	X			X											
Poland									X	X	X				
Portugal								X							
Slovakia							X				X				
Spain								X							
Sweden			X						X		X				
Switzerland										X					
Turkey							X				X				
UK							X								
USA		X			X										

(ESF, 2008; HAL, 2009)

* France has two prominent research institutes that have been charged with drafting a national research integrity strategy.

** Ireland's Health Research Board has drafted principles and misconduct guidelines, but these are not national in scope, nor do they apply across all granting agencies.

*** Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) has produced a set of research integrity guidelines, but these are non-binding.

Non-Legislated Systems, Advisory Bodies

Systems in which a body whose character and mandate is not established through legislation (or not legislated), but defines research integrity and provides guidelines for dealing with misconduct, are much more common than those established through legislation.

In Germany, for example, the national granting council, the Deutsche Forschungsgemeinschaft (DFG), and the independent and influential Max Planck Society, have established research integrity guidelines that include definitions of good scientific practice and research misconduct. The implementation and enforcement of these guidelines fall to individual institutions: an approach that is respectful of academic freedom and responsive to local circumstances. The result, however, can be differing interpretations of what constitutes misconduct, and uneven application of policies. The DFG has also created an independent mediatory Office of Ombudsman to provide information and standardized, confidential advice to involved parties. This entity does not possess investigative or regulatory powers.

The main Austrian and Slovak granting councils, the Austrian Science Fund and the Slovak Research and Development Agency, currently follow DFG guidelines. Austrian stakeholders, however, are considering the establishment of a central independent body to deal with cases of misconduct as part of a larger research integrity strategy.

In other countries, a national advisory or academic body, other than a granting agency, has prepared research integrity guidelines and recommendations for use in individual institutions. For example, in 1991 the Ministry of Education set up the Finnish National Advisory Board on Research Ethics as part of a network of advisory bodies to address ethics-related issues in science and technology. Its publication, *Good Scientific Practice and Procedures for Handling Misconduct and Fraud in Science*, combines principles of good scientific practice with definitions of misconduct and fraud, and includes recommendations on handling allegations of impropriety (National Advisory Board on Ethics, 2002). As the National Advisory Board does not conduct inquiries or arrange oral hearings, the responsibility for implementation, enforcement, and promotion of good values lies with the institutions.

All of these examples share certain fundamental features. Unconstrained by legislative structures, they present expansive definitions of research integrity as well as provisions for identifying and addressing misconduct. They promote responsible practice while seeking to ensure necessary compliance. In general, individual institutions play a major role in the administration of these policies and guidelines, although the emphasis on promoting a positive research integrity environment versus focusing on misconduct differs from system to system.

Non-Legislated Systems, No Advisory Bodies

In recent years, research integrity has been the subject of much international attention (see Box 2.1). In 2007, the Global Science Forum[15] of the Organisation for Economic Co-operation and Development (OECD) issued a consensus report, *Best Practices for Ensuring Scientific Integrity and Preventing Misconduct*, which noted that "ensuring integrity in science is a complex, multifaceted task, touching upon education, publication, the functions of scientific and academic institutions, and the responsibilities of funding agencies" (OECD, 2007, p. 1). In addition, numerous conferences and events, including a recent Canadian conference on research integrity, have highlighted the role of peer-reviewed journals and their editors in ensuring integrity of publication (NCEHR, 2010).

The Australian research integrity system is currently national in scope, but lacks legislated sanctioning powers and a national advisory body. It centres on a *Code for the Responsible Conduct of Research* (Grose, 2010), a comprehensive set of principles and practices for encouraging responsible research, and a framework for resolving misconduct allegations, crafted by the National Health and Medical Research Council (NHMRC), Universities Australia, and the Australian Research Council (ARC). The administration and enforcement of the Code, as well as the promotion of its values, are the responsibility of individual institutions; there is no centralized oversight body.

The research integrity system in Australia is in more of a developmental stage than that of the United States, and many parties believe a central or national body should be established to provide independent advice, assess institutional processes, and oversee and update the Code. In 2009, the National Health and Medical

[15] The OECD's Global Science Forum (GSF) brings together science policy officials from OECD countries to identify and maximize opportunities for international cooperation in basic scientific research.

Research Council, the Australian Research Council, and the Department of Innovation, Industry, Science and Research, seeking consultation, posted a draft *Proposal to establish an Australian Research Integrity Committee* (NHMRC, ARC & Department of Innovation, Industry, Science and Research, 2009). The proposed national body would leave investigative activity to the institutions, but provide advice and assistance, assess institutional processes, serve as an appeals body, and take on cases with potential conflicts of interest.

Box 2.1 Recommendations from the International Council for Science Committee on Freedom and Responsibility in the Conduct of Science (ICSU CFRS)

Following the First World Conference on Research Integrity, which took place in Lisbon, Portugal in 2007, the CFRS recommended the "establishment of clear and transparent national monitoring and advisory mechanisms for research integrity." The objectives of such mechanisms are to:

- provide oversight for research integrity issues at a national level;
- facilitate collection of data on the incidence of reports of errors in the scientific record and of scientific misconduct;
- provide oversight and advice for institutions;
- provide an avenue for appeal in individual cases of alleged misconduct;
- formulate and revise codes of conduct;
- facilitate international compatibility of standards for scientific conduct; and
- facilitate the investigation of concerns about errors in the literature, particularly when they involve international collaboration (ICSU CFRS, 2008).

2.2 CANADIAN INSTITUTIONAL APPROACHES

Within Canada, the research integrity system is non-legislated and decentralized, leaving it to individual institutions to police and discipline research integrity infractions. HAL (2009) described the Canadian policy landscape as "multi-faceted and multi-levelled, comprising a mix of policies, codes of conducts, and guidelines" on various aspects of research integrity and research misconduct (p. 7).

To the extent that there is any form of centralized or uniform approach to research integrity, it is due in large part to the *Tri-Council Policy Statement on Research Integrity and Scholarship* (TCPS-IRS). As stated in Chapter 1, most public institutions in Canada rely on one or more of the three federal granting agencies for the majority of their research funding. Given that receipt and administration of funds through any of these agencies requires compliance with, among other policies, the TCPS-IRS, it is not surprising that most institutional policies exhibit at least a common foundation to their approaches to research integrity. Thus an examination of Canadian institutional approaches to research integrity reveals many parallels in the methods adopted by different institutions (see Appendix E for a more detailed discussion).

2.3 REVIEW OF THE CURRENT SCHOLARSHIP

A growing number of reports have outlined a variety of pressures, inherent within the modern research enterprise, that pose challenges to its integrity (Arthurs, Blais, & Thompson, 1994; Freeman, Weinstein, Marincola, Rosenbaum, & Solomon, 2001; Thompson, Baird, & Downie, 2001; IOM and NRC Committee on Assessing Integrity in Research Environments, 2002; Pencharz, 2007; American Academy of Arts and Sciences, 2008). Many of these reports have suggested that, given current realities, it is unlikely that anything short of significant changes in the prevailing research context would adequately address these pressures. Developing a response to these findings, however, poses severe challenges, as there is very little research that assesses the viability of any of the alternative solutions that are currently being tested or have been recommended.

Despite this absence of systematic research, there is an emerging consensus that compliance-based approaches, with their primary focus on disciplining misconduct, are unlikely to be effective in and of themselves (IOM and NRC Committee on Assessing Integrity in Research Environments, 2002; Keith-Spiegel & Koocher, 2005; Martinson, Anderson, & de Vries, 2005; Martinson, Anderson, Crain & de Vries, 2006; Nylenna & Simonsen, 2006; Vasgird, 2007). Furthermore, there is no definition of research misconduct generally accepted as complete. Legislated models are frequently based on falsification, fabrication, and plagiarism (often accompanied by indeterminate allusions to other questionable practices). This approach, however, fails to adequately address a wide range of ethically unacceptable behaviours such as laxity, negligence, and recklessness (Cossette, 2004; Nylenna & Simonsen, 2006; OECD, 2007; Martinson *et al.*, 2009).

In recognition that an exclusive focus on investigating and sanctioning individual offenders for this range of offences is too narrow to promote responsible conduct, recent attention has turned towards education and other means of promulgating ethical research and ethical research environments (IOM and NRC Committee on Assessing Integrity in Research Environments, 2002; Gibelman & Gelman, 2005; Steneck, 2006). There has also been a growing focus on environmental factors such as institutional environments and external pressures, and the viability of broad, positive, principles-based models for preventing research misconduct (de Vries *et al.*, 2006; Martinson *et al.*, 2006; Anderson *et al.*, 2007a; Kalichman, 2007; Thrush *et al.*, 2007; Fisher, Fried, Goodman, & Germano, 2009; Martinson *et al.*, 2009).

Management studies on private-sector behaviours have shown that the "ethical culture" of an organization is often an unperceived and unmanaged reality within the workplace (ERC, 2010a). An Ethics Resource Center report (2010a) suggested that "the strength of a company's ethical culture is the extent to which the organization makes doing the right thing a priority" (p. 1). The report pointed out that a strong ethical organizational culture:

- encourages employees to resist pressure to compromise standards;
- reduces the rate of observed misconduct;
- increases the likelihood that employees will report any observed misconduct; and
- reduces the likelihood that those who report misconduct will experience retaliation.

These observations hold not only at the organizational level, but also at the national level (i.e., the U.S. workforce). The report emphasized the role of senior leaders in creating and promoting high ethical cultures through effective communication of standards and policies, and by practicing/exhibiting these principles in their personal, daily comportment. The report further recommended that companies invest the time required to (i) develop and promote programs that encourage ethics as a priority; (ii) increase awareness and visibility of company standards among employees; and (iii) perform regular assessments to track the progress over time of promoting a high ethical culture.

Researchers in psychology and organizational behaviour have studied the concepts of organizational climate and culture for over 50 years. According to Landy and Conte (2010), the two are generally viewed as overlapping, yet distinct, features of an organization, each of which can either work to support, or to hinder, its goals. Studies have provided strong evidence that individual conduct is influenced by a shared perception (i.e., climate) and value/belief pattern (i.e., culture) among group members (pp. 635-640).

Studies carried out by Hoffman, Jacobs, and Landy (1995) on safe behaviour in the workplace proposed three levels of organizational responsibility, with each playing a complementary role. The *individual level* is based on the premise that individuals are responsible for their own attitudes and behaviour regarding, and knowledge of, safe practices. The *micro-organizational level*, representing management attitudes and accountability mechanisms, relies on a willingness to self regulate, rather than depend on external compliance regulation, and to work with joint labour management groups (e.g., safety committees). The *macro-organizational level* focuses on issues such as communication, decision making, and workforce specialization.

The IOM and NRC Committee on Assessing Integrity in Research Environments (2002) also highlighted the impossibility of forming conclusions about one single best approach because of the scarcity of research specific to research integrity. As a result, the Committee structured its analysis on an *open systems* model commonly used in organizational and administrative theory. Based on this model, the Committee analyzed how the various components of the system could influence integrity within a research environment. The Committee concluded that all components of the system (i.e., inputs of funds and other resources, organizational structure and processes, culture and climate of an organization, and the external environment) could affect behaviour and alter, either positively or negatively, institutional integrity.

The foregoing evidence points to the need for a system-based approach. Since the study of research integrity is a new field of research, such an approach must logically draw on the theories, methods, and measures of various disciplines whose core content can speak to the central issues of concern. The nascent empirical literature on research integrity has drawn upon fields such as health, sociology, criminology, social psychology, organizational psychology, epidemiology, education, management, and others (Nylenna & Simonsen, 2006; Kumar, 2010).

Caution is obviously warranted when applying findings or observations from non-academic to academic settings, as the two may have somewhat different features in terms of their organizational structures, hierarchies of authority, and cultural and normative orientations (Anderson, Ronning, de Vries, & Martinson, 2010).

Recent studies on research integrity have proposed two motivational categories that drive research misconduct: (i) proclivities or individual tendencies towards malfeasance; and (ii) opportunities or the environmental conditions that induce misbehaviour, even in those not ordinarily so inclined (Adams & Pimple, 2005; Martinson *et al.*, 2006; Mumford *et al.*, 2006; Mumford *et al.*, 2009; Resnik, 2009).

Survey data from one study indicated that, among scientists, the perception of organizational injustice in their surroundings correlates with the likelihood of misbehaviour or misconduct (Martinson *et al.*, 2006; Martinson, Crain, de Vries & Anderson, 2010). Similarly, the heightened competitiveness of much contemporary scientific research has been connected to undesirable tendencies, including "less sharing of information and methods, sabotage of others' ability to use one's work, interference with peer-review processes, and careless or questionable research conduct" (Anderson, Ronning, de Vries, & Martinson, 2007b, p. 443; de Vries *et al.*, 2006). Improvements in the equitable distribution of human, physical, and financial resources, and the alleviation of potentially toxic pressures to produce research volume at all costs, could potentially reduce instances of misconduct by changing the environment in which research is conducted.

The process of identifying best practices in educational routes to produce research integrity is currently in flux. Tensions between compliance with regulatory requirements and a more wholehearted embracing of integrity principles is apparent in ongoing discussions and work aimed at identifying the most important educational content and the most effective teaching methods for ensuring research integrity. Institutional interests and political pressures have tended to focus educational initiatives for the responsible conduct of research (RCR) towards more mechanistic "teaching of the rules," and how to comply with them (Vasgird, 2007; Olson, 2010). At the same time, educators and ethics professionals have continued to push for the development of educational programs whose content goes beyond just the teaching of the rules, and includes discussions of moral reasoning and problem solving, ethical principles, and scientific values (Heitman & Bulger, 2005; Kalichman, 2007; Steneck & Bulger, 2007). Such initiatives seek to move the focus away from compliance-centred approaches and towards fostering a research integrity environment that embraces a more comprehensive values and principles approach.

Of note, research has begun on how mentoring, education in professional ethics, and appropriate workshops or other methods might positively influence researcher behaviour (Fischer & Zigmond, 2001; Wright, Titus, & Cornelison, 2008; Fisher *et al.*, 2009). The mixed success of past training and educational efforts (Anderson *et al.*, 2007a; Antes *et al.*, 2009) may be due to the paucity of research in this nascent area (Steneck, 2006; Steneck & Bulger, 2007). Much more research needs to be conducted on programs to develop relevant skills training through role playing, modelling, and focused problem solving of real research ethics cases. Fields such as applied and organizational psychology provide many examples of research programs that have positively affected a variety of important social behaviours (e.g., Edwards, Tindale, Heath, & Posavac, 1990).

2.4 RESEARCH INTEGRITY IN CANADA: THE STATUS QUO

The TCPS-IRS is the centrepiece of the current Canadian research integrity system. Like similar models in Germany and Austria, it sets out a framework that institutions receiving funding must adopt. The TCPS-IRS encompasses two sections: (i) principles of scholarly integrity and the responsibilities of researchers, institutions, and agencies towards upholding them; and (ii) procedures to address misconduct (NSERC, CIHR & SSHRC, 2009b, Section 1, para. 1).

Institutions must implement the policy in conformity with their own particular circumstances. The TCPS-IRS places the responsibility for high research standards with the individual researcher, and charges institutions with preventing and investigating misconduct. It advocates prevention by "developing awareness among all involved of the need for the highest standards of integrity, accountability and responsibility," including the active promotion of information sessions, policies, and "programs for the education of researchers, scholars, trainees and staff" (NSERC, CIHR, & SSHRC, 2009a, Section 2a, para. 1). Institutional compliance with this aspect of the policy, however, is neither monitored nor reported.

Figure 2.1 outlines the general process that is followed in Canada for investigating allegations of research misconduct. In this model, individual research institutions are responsible for investigations. Tri-Council involvement is triggered when one of the three granting agencies directly receives an allegation of misconduct from a concerned individual (e.g., an individual researcher or journal editor), or an institutional administrator. In these cases, agency representatives liaise with institutional leaders/administrators as the investigation unfolds under the specific protocols of the institution.

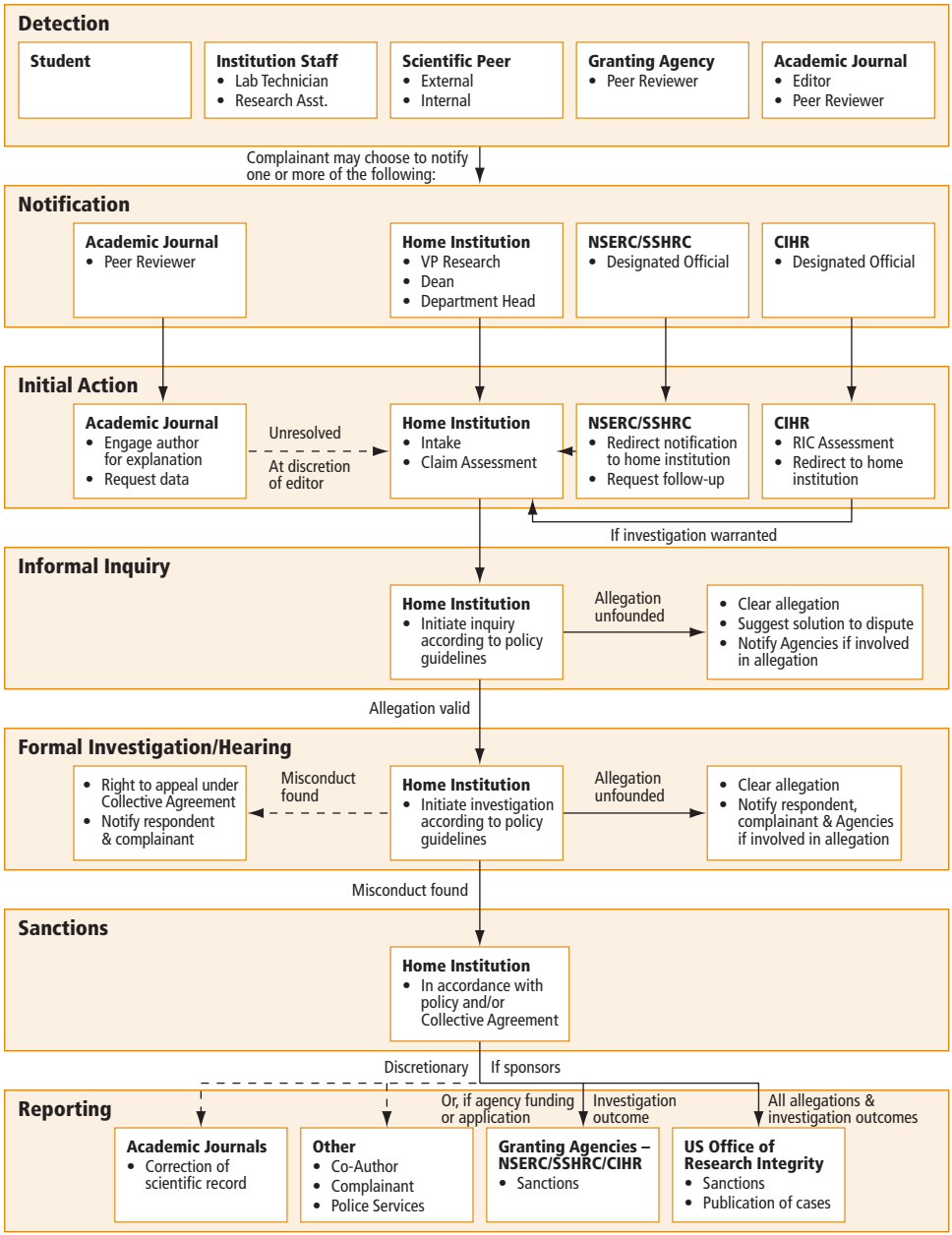

Figure 2.1

General Management Procedure for Research Misconduct Allegations in Canada

(Adapted and reprinted with permission from T. Creutzberg *et al.* (2009). *The State of Research Integrity and Misconduct Policies in Canada*, Hickling Arthurs Low)

To be eligible for funding, institutions must have in place a policy for research integrity and misconduct (see Appendix F for a number of policies consulted by the Panel). As discussed earlier, although these policies generally conform to the TCPS-IRS, there is considerable variety in the details of individual misconduct procedures. Institutional and Tri-Council commitments are recorded in a Memorandum of Understanding (MOU). A specific MOU schedule, between the Tri-Council and eligible institutions, sets out the role of each party in governing research integrity. While institutional policies must comply with principles and guidelines set out in the TCPS-IRS, the Tri-Council intends that institutions also consult the *Framework for Tri-Council Review of Institutional Policies Dealing with Integrity in Research* (the Framework) (NSERC, CIHR, & SSHRC, 1996; NSERC, CIHR, & SSHRC, 2009a) for further guidance on specific items to be covered by these policies. The Framework also includes a fairly detailed procedure for processing misconduct allegations.

The Tri-Council has recently extended the reach of the TCPS-IRS to non-eligible institutions that collaborate with eligible ones. Specifically, a new MOU schedule, which came into force in 2009, requires any secondary institutions to apply the relevant Tri-Council policies in administering funds received from a primary (eligible) institution (NSERC, CIHR, & SSHRC, 2009c).

2.5 THE CANADIAN APPROACH: WHAT IS MISSING?

The Panel's analysis considers the findings of previous reports on research integrity and research misconduct in Canada (see Appendix G), along with testimonies and statements provided by stakeholders (see Appendix C), to ascertain the strengths and weaknesses of the current Canadian system. According to the HAL report (2009), the Canadian system is perceived as functioning well by those who work within it, and compares relatively well with other models. The report identified several weaknesses, however, including the TCPS-IRS's passive "fire alarm" approach to research misconduct, and its reactive, rather than proactive and preventive, nature (i.e., most defined procedures deal with improper behaviour after it is alleged to have occurred).

The Panel concurs with the weaknesses articulated in the HAL report, and has identified key gaps in the existing research framework, based on the information presented in this chapter. Table 2.2 summarizes these gaps, and the remaining sections of this chapter outline them in more detail. These gaps significantly affect the transparency and accountability of the existing system, thereby threatening its accuracy and trustworthiness. The Panel believes that these gaps must be addressed in order to ensure the ongoing integrity of research in Canada.

Table 2.2

Gaps and Needs in the Existing Research Integrity Framework in Canada

1.	**System-Wide Approach**
	Canada needs:
•	An approach that is inclusive of all disciplines
•	Common definitions of research integrity and research misconduct
•	A proactive, values/principles-driven approach
•	Attention to ALL involved parties, not just to individual researchers
2.	**Information Management and Research**
	Canada needs:
•	Open sharing of information among institutions, and with the public, on all components of the research integrity landscape, including - institutional research misconduct policies and practices - existing educational practices and approaches
•	Collection/compilation of data on research misconduct
•	A central clearing house responsible for gathering and disseminating this information
•	Promotion of research on research integrity
3.	**Education, Training, and Advice**
	Canada needs:
•	Educational initiatives on research integrity
•	Materials on best practices
•	Mentorship, support, and training
•	An independent source of advice on best practices and research integrity issues
4.	**Privacy/Transparency, Conflicts of Interest, and Incentives**
	Canada needs:
•	A balance between privacy legislation and transparency
•	Methods for dealing with institutional conflicts of interest
•	Methods for dealing with research partners outside of the Tri-Council mandate
•	Awareness of and attention to incentives/disincentives to best practices

A System-Wide Approach

Studies in psychology and organizational behaviour and management have shown that awareness and preventative initiatives can play an important role in helping to foster an environment of high ethical standards (Folger, 1977; Folger & Cropanzano, 1998; ERC, 2010a, 2010b). These findings support a framework in which all actors within the research enterprise are both aware of, and committed to, a shared set of values, principles, and actions. In other words, a cohesive system-wide approach, together with an overarching framework of values and principles, is needed to establish a climate that promotes ethical conduct. The Panel concludes that these components are necessary, but not sufficient, conditions for establishing an effective research integrity system. For such an approach to be effective when misconduct does occur, mechanisms to identify and administer sanctions must also be in place. This type of approach is consistent with most international systems of research integrity.

Since academic environments are remarkably diverse and heterogeneous in nature, particularly across the disciplines, any system-wide approach must be relevant to the various disciplinary and methodological approaches at play in scholarly practice. That said, leaders in research have a unique role to play in setting an example for those they manage. Notably, continuous monitoring of the overall research integrity environment is needed to track progress over time, and to encourage accountability for the implemented initiatives and efforts (IOM and NRC Committee on Assessing Integrity in Research Environments, 2002).

Information Management and Research

In gathering evidence for its task, the Panel became aware of the overall scarcity of information on various aspects of the research integrity landscape in Canada, particularly with respect to the social sciences and humanities. Information regarding institutional policies on research integrity and research misconduct, while available, remains scattered and not readily accessible to individuals seeking to consult, compare, or evaluate current best practices. Similarly, there is limited access to, and awareness of, materials currently used in Canada to promote research integrity. This inaccessibility hinders information sharing among institutions, and with the public in general.

As discussed in Section 1.3, there is also a lack of data on the prevalence of, and trends in, research misconduct. While this is not a uniquely Canadian phenomenon, it does represent a gap in the capacity to evaluate the extent of the issue as well as to monitor the effects of any initiatives taken towards reducing occurrences of misconduct in the future. There is a strong need for a centralized system, a sort of "clearing house," to create, gather, manage, and distribute research integrity information.

Finally, the lack of information and research on the effectiveness of alternative approaches severely limits the evaluation and comparison of their relative success. Evidence from scholarly material (see Section 2.3), regarding the effectiveness of preventative and educational initiatives in promoting environmental and behavioural changes, also limits a conclusive analysis of the most effective means to create environments that encourage and support high standards of ethical conduct. Further supporting the lack of research in this area, starting in 2001 in collaboration with the NIH, the U.S. Office of Research Integrity has issued annual calls for research proposals on research integrity, and has sponsored five research conferences on the subject. These points all speak to the need for more research to enable more conclusive, evidence-based decisions regarding best practices and future initiatives.

Education, Training, and Advice

As mentioned previously, there is conflicting evidence about the effect of educational programs and activities on modifying an individual's behaviour or "ethical compass." Based on the evidence from other disciplines (e.g., psychology, organizational behaviour and management), the work of other research-related bodies in Canada (e.g., Interagency Advisory Panel on Research Ethics), and the experiential evidence of Panel members, the Panel concludes that a consistent, system-wide approach to fostering research integrity in Canada requires (i) effective education and training; (ii) materials on best practices; and (iii) up-to-date curricula and training information for all actors within the research community. Those responsible for the management of research and its funding must also commit to, and be supported in, their roles as mentors, training/support providers, and monitors.

Within the existing structure, the Tri-Council provides overarching policies and guidance on their implementation. This is the same entity that can impose or level sanctions on individuals or institutions that are deemed non-compliant with research integrity policies. Evidence from workplace studies suggests that the fear of repercussions is one of the dominant dissuaders of trust between employees and managers, which greatly decreases the likelihood of open and frank discussions on issues of misconduct (ERC, 2010a). This evidence is consistent with anecdotal reports regarding the ORI in the United States. Although the ORI serves in both a sanctioning and an educational/advisory capacity, it is generally perceived as maintaining a primarily governing structure, and plays a somewhat adversarial role to academic institutions. This narrowed conception of its role minimizes the ORI's effectiveness as an independent and trusted source of advice to the community. As such, the Panel concludes that there is a need for an independent source of advice on best practices and research integrity issues within Canada.

Privacy/Transparency, Conflicts of Interest, and Incentives

Currently, there is an imbalance between federal and provincial privacy legislation, and the need for transparency. Although the Panel recognizes the importance of maintaining the privacy of individuals during an investigation, investigative findings should be reported and made public if an individual or institution is found guilty of research misconduct. Similarly, the fact that an allegation is under investigation should be reported if an individual who is subject to an allegation resigns (either by mutual or unilateral decision) before the end of the investigation. Even if an individual resigns, any investigation initiated prior to the resignation should be completed and the findings reported. A commitment to reporting misconduct in this manner, together with institutional adherence to timely and open due diligence protocols, would help ensure the transparency and accountability of the research enterprise.

An examination of Figure 2.1 reveals that nearly all current investigative authority in Canada lies with the institution at which a misconduct is alleged to have occurred. This approach presents an inherent conflict of interest in that the reputation and productivity of an institution rely on the outputs generated by its individual researchers. In turn, the pursuit of an allegation relies heavily on an institutional manager placing the immediate "best interests" of the institution on hold, with a view to upholding its commitment to Tri-Council integrity standards.

Although the TCPS-IRS has begun to extend its reach, it is unable to impose ethical standards on research conducted by external partners that are not (or jointly) sponsored by one of the Tri-Council agencies. This inability is a key gap in the existing framework. The administration of research monies does not always clearly delineate research sponsored by one source versus another. More often, the funding is pooled and distributed to support the same, or closely related, research initiatives within a research group. As such, in the interest of protecting the integrity of all involved parties, principles, guidelines, and standards must be clear and applicable to all research, irrespective of the sponsor.

The current framework also inadequately deals with the challenges to integrity resulting from the incentives and disincentives that influence academic research. For example, existing promotion and funding evaluations do not attach a significant value to the contributions of researchers to mentoring and training their junior colleagues. Taking these kinds of factors into consideration would, in the Panel's view, encourage researchers to engage in activities designed to strengthen commitments to research integrity and balance incentives based exclusively on productivity metrics.

Chapter 3 Developing a System-Wide Research Integrity Environment

A multifaceted, comprehensive approach to the Canadian research integrity framework must define and foster the development of a set of values and fundamental principles that are shared by all participants in the research enterprise. It must offer opportunities to recognize and promote exemplary behaviours, as well as identify and administer sanctions for egregious behaviours. Finally, it must provide a means of developing best practices with respect to promotion, education/training, and counselling, and offer ways of checking the effectiveness of those programs with the ultimate end of encouraging research that reflects high standards of integrity while discouraging undesirable practices.

Figure 3.1 shows, schematically, the relationships among the three key elements of a positive research integrity environment: a common definition of research integrity, shared values, and shared principles. The figure also shows the three components needed for the effective implementation of these elements: promotion, prevention, and sanction. This chapter defines the key elements, and explores the relationship between the three components and the gaps in the current framework (see Chapter 2). It also proposes mechanisms to address these gaps to foster a positive research integrity environment.

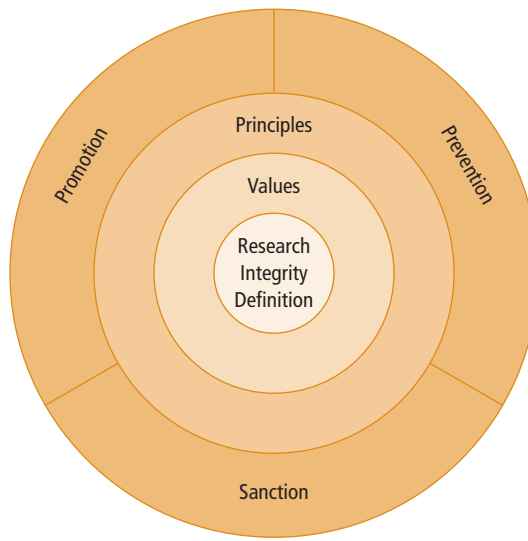

Figure 3.1
Key Elements and Components of a Positive Research Integrity Environment

3.1 DEFINING THE KEY ELEMENTS

Research Integrity

The charge tasked the Panel with developing a common definition of research integrity that would be broad and nuanced enough to capture a range of circumstances and conduct, yet appropriately narrow to allow for sound interpretation and fair application. The Panel wholeheartedly believes that such a definition, as proposed below, is the cornerstone of a positive research integrity environment.

> Research integrity is the coherent and consistent application of values and principles essential to encouraging and achieving excellence in the search for, and dissemination of, knowledge. These values include *honesty*, *fairness*, *trust*, *accountability*, and *openness*.

Core Values

The five core values[16] in the definition are the founding block, and the absolute minimal requirements, for building this type of positive environment. These values are based on Canadian and international examples, as well as the Panel's original thinking. Actors in the research enterprise at all levels, across all disciplines, must be committed to incorporating and demonstrating these values in every facet of their professional careers.

Honesty	Being straightforward, and free of fraud and deception
Fairness	Being impartial and using sound judgment free of prejudice or favouritism
Trust	Being reliable, as a person or institution, through character and action
Accountability	Being responsible and answerable for one's actions
Openness	Being transparent in process and practice, as characterized by visibility or accessibility of information

[16] The definitions of the five core values proposed in this section are suggested as operational definitions.

Fundamental Principles

The core values and the common definition of research integrity must lead to a shared set of principles that govern all actors who conduct, manage, and fund research in Canada. The Panel has developed 11 fundamental principles, each of which relates to one or more of the five core values.[17] To enact a positive research integrity environment, members of the research community should:

1. Conduct research in an honest search for knowledge: A fair, open, and reliable approach to all activities that support, fund, or otherwise encourage research. (*Honesty; Fairness; Trust; Openness*)
2. Foster an environment of research integrity, accountability, and public trust: Individuals and organizations at all levels should take responsibility for creating, implementing, maintaining, and complying with policies and practices designed to ensure accountability and the maintenance of public trust. (*Trust; Accountability*)
3. Know your level of competence and your limitations; act accordingly: Ensure you have the appropriate expertise and experience to participate in a given area of research or research administration. (*Honesty; Trust; Accountability*)
4. Avoid conflicts of interest, or if they cannot be avoided, address them in an ethical manner: Personal and institutional conflicts of interest, or the appearance of conflict of interest, should be avoided. When unavoidable, each instance should be identified, disclosed, carefully examined, and managed in such a way as to avoid any corruption of the research process. (*Trust; Accountability; Openness*)
5. Use research funds responsibly: Individuals and organizations at all levels should ensure the responsible allocation and management of research funds in accordance with sound academic and financial principles. (*Honesty; Accountability*)
6. Review the work of others with integrity: Individuals and organizations should engage in, and organize, peer review and the evaluation of the work of others in a manner that reflects the highest scholarly, professional, and scientific standards of fairness and confidentiality. (*Fairness; Trust*)
7. Report on research in a responsible and timely fashion: Publications, including clear statements of data and methodology, as well as research activities and research results, should not be unduly delayed or intentionally withheld. These considerations should be configured within each discipline's own timeframe. (*Trust; Openness*)

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[17] Values have been italicized in parentheses.

8. Treat data with scholarly rigour: The highest levels of exactitude should be ensured in proposing, performing, recording, analyzing, interpreting, reporting, publishing, and archiving research data and findings. The appropriate authorities, as mandated by applicable standards or regulations, should retain a copy of research records. (*Honesty; Accountability*)
9. Treat everyone involved with research fairly and with respect: All individuals and institutions directly affected or involved in research, including human subjects and animals, should be treated fairly and with respect. Relevant regulations and applicable Tri-Council and institutional policies should be followed and guided by common principles and values. (*Fairness; Trust*)
10. Acknowledge all contributors and contributions in research: All contributors and contributions to research and research results, including financial contributions, should be acknowledged fairly and accurately whenever research is communicated. (*Fairness; Accountability; Openness*)
11. Engage in the responsible training of researchers: Research investigators, particularly new scholars, should have access to education, mentoring, and support to develop and maintain the skills and capacities required for conducting and managing research in accordance with relevant scholarly and ethical standards. An individual's level of responsibility should be commensurate with his or her competence and experience. *(Fairness; Trust)*

3.2 RESEARCH MISCONDUCT

Although a shared set of positive values and principles fosters a positive environment of awareness, which serves as a preventative measure against any egregious conduct, mechanisms must also be in place to identify and administer sanctions when misconduct does occur.

The development and implementation of procedural mechanisms surrounding research misconduct rely, first, on a clear definition of what constitutes unacceptable conduct. There is ongoing debate within the academic literature and international policy arenas regarding the best approach towards defining research misconduct. Forsman (1999) and Andersen (2007) have described the conflicting views as arising from the tension between ethical and epistemological considerations. On one hand, there is a call for a broad definition that considers the public's trust and protection from false results. On the other hand, there is a desire to narrow the definition in such a manner as to not preclude or discourage novel or unorthodox research methods that could ultimately lead to important discoveries.

Steneck (1999) examined the impact of adopting a broad versus narrow definition by two agencies in the U.S. system (i.e., the Public Health Service and the National Science Foundation). He concluded that "there is no reason to believe…that a new definition or any one definition of misconduct in research will…significantly increase, decrease or otherwise affect the integrity of research" (p. 166). Rather, what is important is the interpretation and administration of whatever definitions are in place.

Resnick (2003) identified five competing goals inherent to defining research misconduct: (i) legal prevention of fraud; (ii) moral and political goals; (iii) promotion of education in research ethics; (iv) promotion of effective enforcement of misconduct rules; and (v) integration of misconduct within the larger framework of research integrity. He then proposed a definition to reconcile all these competing interests. This definition contains a clear distinction between misconduct and punishable misconduct, thereby reconciling the tension between legal and ethical considerations.

In its deliberations to define research misconduct, the Panel considered the issues outlined above and its own definition of research integrity, and also reviewed existing Canadian and international definitions (see Appendix H). Ultimately, the Panel concurs with and supports the preceding arguments, and supports the need to balance competing goals with the potentially conflicting end uses of a research misconduct definition. As such, the Panel has approached research misconduct from the perspective of behaviours that undermine the core values underlying research (see Box 3.1), which would be equally applicable at all levels of the research enterprise (i.e., individuals, institutions, funding bodies). Informed by this rationale, the Panel has developed a definition of research misconduct and a list of what it deems inappropriate behaviours (see Table 3.1, A and B).

Based on its definition of research integrity, the Panel defines research misconduct in the following way:

> Research misconduct is the failure to apply, in a coherent and consistent manner, the values and principles essential to encouraging and achieving excellence in the search for knowledge. These values include *honesty*, *fairness*, *trust*, *accountability*, and *openness*.

Box 3.1 Publishing of Research: A Look at Moral Rights

One example of a behaviour or action that represents a serious threat to research integrity is the issue of moral rights of an author. In Canadian copyright law, moral rights are different from economic rights, and according to Creative Commons Canada (2010), an author's moral right protects his or her work from mutilation or distortion. Due to the unique connection between creators and their creative works, the moral rights provision attempts to protect authors' rights to the integrity of their work: "Regardless of whether the economic rights in a creative work have been sold, the work cannot be so modified as to constitute a mutilation or distortion that would harm the honour or reputation of the creator. The right of integrity also protects creators from having their works associated with products, services, causes or institutions that would harm their honour or reputation" (para. 4,5).

Research contracts between academics and the public sector (i.e., those outside Tri-Council funding agreements) often ask researchers to waive their moral rights. The Treasury Board even provides similar draft language for inclusion in research contracts funded by federal departments and agencies (Treasury Board of Canada Secretariat, 2008). Ultimately, this may seem appropriate to funders because they obtain greater flexibility in the further use of the contract's deliverables (Creative Commons Canada, 2010).

Of note, universities have often attempted to remove these clauses from contracts because the language is at odds with the basic tenets of academic research. An agreement on the part of a researcher or institution to waive moral rights would violate several of the five core values outlined in this report, and, as such, constitute an example of research misconduct.

In response to sub-question 3,[18] the Panel has developed a proposed framework for various kinds of misconduct and questionable research practices, based on the values and principles, the materials considered, and the Panel's own experiences and expertise. The framework, as set out in Table 3.1, proposes two broad categories of behaviour worthy of concern:

- misconduct that institutions should investigate and *must* report to the Tri-Council; and
- misconduct and questionable research practices that institutions should investigate and *may* report to the Tri-Council.

Any such division, and any listing of specific acts (as shown in Table 3.1), is subject to discussion, interpretation, and modification. The Panel thus offers a proposed framework for guidance in Canada's complex, and often decentralized, research environment. Indeed, the Panel hopes its specific approach will be discussed by the institutions, the Tri-Council, and other actors, and modified as appropriate.[19]

Table 3.1A

Misconduct that Institutions Should Investigate and Must Report to the Tri-Council

Fabrication	•	fabrication of research data, source material, methodology, or results
Falsification	•	falsification of data or results, including any manipulation of numbers, graphs, and images, that is not reported and that distorts the conclusions of a study
Plagiarism	•	using another's words or ideas without giving proper credit
Financial misconduct	•	using research funds for purposes inconsistent with the objectives of the funding agency; the misappropriation of research funds
Disregard for specific policies and regulations	•	failure to meet relevant legal requirements that relate to institutional policies (e.g., policies that protect researchers, human subjects, the health and safety of the public, the welfare of lab animals, and those dealing with biohazards or radioactive materials)
	•	failure to obtain the appropriate approvals before conducting research; failure to meet relevant legal requirements on the conduct or reporting of research and scholarly activity

This table is partly based on the Queen's University (2009) document, *Senate Policy on Integrity in Research*, with some material taken verbatim from that source.

[18] Sub-question 3: *What actions would be considered to constitute research misconduct in a Canadian context?*

[19] The new actor that the Panel proposes in Chapter 4, the Canadian Council for Research Integrity, should also play a key role in such discussions.

Table 3.1B

Misconduct and Questionable Research Practices that Institutions Should Investigate and May Report to the Tri-Council

Misrepresentation of authorship and credit	• failure to appropriately recognize contributions of others (e.g., denying authorship credit to someone who has contributed substantively to the intellectual content of a manuscript or not recognizing contributions of a co-inventor in a patent application) • submission for publication of one's articles published elsewhere (e.g., publishing, as original research, one's previously published data or results) except where clearly indicated to be a republication • attribution of authorship to persons other than those who have contributed sufficiently to take responsibility for the intellectual content (e.g., giving authorship credit to someone who has not contributed substantively to a manuscript) • use of others' unpublished materials without permission • misrepresentation of professional credentials and experience
Deliberate impairment or interference with the progress of research	• selective reporting of reliable and relevant research results with the intent to mislead • abuse of personal or institutional power to pressure researchers into misrepresenting research results • undue delay of the publication of research results • sabotage of the research work or materials of others • deliberate misleading of colleagues on the results and interpretation of a study • interference with a misconduct investigation
Withholding of research information	• omission of key aspects of methodology in papers or proposals to wilfully hamper replication by colleagues • undue withholding of data, research materials, or key aspects of methodology from the research community • failure to inform co-workers in a timely fashion of experimental findings and developments

Misrepresentation or mismanagement of conflicts of interest	• failure to disclose actual or appearance of conflict of interest to institutions, sponsors, commissioners of work, or publishers (e.g., journal editors) when submitting research grant applications or manuscripts for publication, or testing products for sale or distribution to the public • lack of proper disclosure of involvement with firms with an interest in the outcomes of the research • inappropriate alteration or suppression of research results to favour the interest of the funding provider, be it commercial or not-for-profit, such as government or a private foundation
Abuse of peer review	• failure to disqualify oneself in conflict-of-interest situations • failure to preserve the privacy and intellectual rights of the persons whose work one is reviewing • failure to obtain permission of the author before using information gained through access to manuscripts or grant applications during the peer review process • failure to provide rationale for one's judgments in writing peer reviews
Making and pursuit of unsubstantiated or malicious complaints or allegations	
Inadequate mentoring, training, and supervision of students and other research personnel	

This table is partly based on the Queen's University (2009) document, *Senate Policy on Integrity in Research*, with some material taken verbatim from that source.

As Nylenna and Simonsen (2006) have argued, there is a continuum of behaviours in research, ranging from unintentional error to intentional fraud. Research misconduct implies intent, and therefore excludes honest error. Even within the concept of research misconduct, however, there is a complex interaction, between intent and the severity of the misconduct, which defies a simple table or algorithm. Table 3.1 is not intended to deny the complexity of the real cases, which the institutions (and in some cases the Tri-Council) must examine. Moreover, the Panel has not, in Part B, attempted to divide the examples into misconduct and questionable research practices; that division is best left to the institutions, and would presumably depend upon the details of a particular case.

The Part A behaviours, which institutions must report to the Tri-Council, are those that, in general, are most destructive of the research enterprise, and of the public's trust in the outcomes of research. These are the issues for which Tri-Council leadership and institutional commitment are most essential if the objectives of transparency and timely processes (see Chapter 1) are to be reached. It is largely in their dealings with these issues that the institutions and the Tri-Council will be judged by the public as managing research integrity well, or poorly.

The Part B behaviours, which institutions are free to report, or not, to the Tri-Council, significantly impact the quality of research, and the collegial behaviour and teamwork that underlie most advanced research today. It can sometimes be difficult, however, to distinguish misconduct from honest error or misunderstanding, or misconduct (i.e., requiring a sanction) from questionable research practice (i.e., for which education and training may be the appropriate response). Since the Part B behaviours, in certain cases, can be as destructive to the research enterprise as those in Part A, they also deserve very serious attention from the institutions.

In our decentralized environment, individual institutions will have to consider, case by case, whether sanctions are required for Part B behaviours, the severity of any such sanctions, and when to report cases to the Tri-Council. The Panel has also included a long list of such behaviours, to which individual institutions may wish to add, in part, on educational grounds. These issues, along with those in Part A, are the behaviours that must be discussed in any effective program of education and training on research integrity.

3.3 THE THREE COMPONENTS: PROMOTION, PREVENTION, AND SANCTION

The Panel has identified three key components of a system-wide approach that will help foster a positive research integrity environment: promotion, prevention, and sanction.

Promotion involves establishing common definitions, values, and principles to guide actors in their daily conduct. The Panel concludes that a system-wide approach, together with common definitions and an overarching framework of values and principles, will provide the required coherence across the Canadian system.

Prevention provides a means of developing best practices with respect to promotion, education/training, and mentoring. It also offers ways of checking the effectiveness of those programs, the ultimate goals of which are to encourage research that reflects the highest standards of integrity, and to discourage undesirable practices. In Canada, prevention requires a commitment from the five key actors to engage in open and ongoing information sharing and dialogue on issues of promotion, education, and mentoring.

Sanction ensures that mechanisms are in place to address misconduct cases that occur. Measures must be taken to establish timely and open due diligence protocols to maintain peer, stakeholder, and public trust in the research community's practices and products. This component is essential, yet not sufficient, to ensure the transparency and visibility of the research enterprise. It must be implemented in conjunction with promotion and prevention (see Box 3.2).

3.4 FILLING IN THE GAPS

Based on the Panel's analysis of the current context, the gaps identified within the existing framework (see Section 2.5), and in consideration of the challenges discussed in Chapter 1, it concludes that an effective Canadian system for research integrity requires the proactive promotion of research integrity throughout the research community. Although the *Tri-Council Policy Statement on Research Integrity and Scholarship* (TCPS-IRS) supports a climate of research integrity that is created and maintained through local policies and promotion of activities, the current governance model, based on institutional responsibility (with limited central oversight through the Tri-Council), is insufficient to support the fully integrated, accountable system.

Box 3.2 A Lesson on Prevention from a Medical Field: Cancer

Consider the following statements:

- Falsification, fabrication, and plagiarism (FFP) are rare and serious threats to research integrity.
- Eradicating FFP is primarily a matter of quickly catching and sanctioning individual "bad actors."
- This is the primary means of ensuring research integrity.

Do all of these statements seem "true"?

Now consider a different, yet similar set of statements:

- Mesothelioma is a rare and serious type of cancer, often affecting the lung.
- Eradicating this type of cancer is primarily a matter of quickly identifying and treating the "bad" or damaged cells.
- This is the primary means of ensuring lung health.

Medical and public health professionals would point out that the last two statements represent an oversimplification of a complex problem. Focusing exclusively on the reactive treatment of this cancer overlooks other considerations, such as environmental exposure as a potential risk factor. If mesothelioma is caused by exposure to known carcinogens (e.g., asbestos), then eliminating exposure to these entities can also contribute to the eradication of the disease.

It is also well established that ensuring lung health goes well beyond simply treating one adverse condition. Cardiovascular exercise and avoidance of tobacco smoke are both known to be effective ways of promoting lung health. A comprehensive approach to lung health must include both proactive and/or preventative measures, in addition to more reactive, treatment-focused approaches.

Keeping in mind this example, reconsider the original three statements. While concerns about FFP and efforts to prevent it are an important component, they are not sufficient to ensure the overall health of the research enterprise (i.e., its integrity). As with the cancer example, proactive and/or preventative measures must be in place to mitigate the potential for FFP, or other undesirable behaviours, and to promote research integrity within the scientific enterprise.

Examining the Options

The Panel's examination of previous reports that have evaluated research integrity, or its various aspects, reveals several proposals for strengthening the Canadian approach. Pencharz (2007) detailed the results of a review of Memorial University's research integrity policies, processes, and initiatives from the early 1990s. The university commissioned the report in response to allegations of misconduct pertaining to one of its researchers. Pencharz also made some national-level recommendations, the most notable of which called for the creation of a National Research Integrity Agency (NRIA), an independent, but government-funded, organization with a broad mandate to cover all research areas, regardless of funding source or sector. He believed that such a body could have played an important advisory role in Memorial University's previous dealings with allegations of misconduct.

In response to this report, Kondro (2007) cited Dr. Pencharz as going beyond his Memorial report recommendation, stating that the most effective form of the proposed NRIA remains unknown. Further, Kondro viewed Pencharz as advocating for an agency similar to those in the United States and Denmark, which were enacted and empowered through legislation, and serve both sanctioning and advisory roles.

A National Council on Ethics in Human Research (2008) report proposed the formation of the Canadian Council for the Protection of Human Research Participants (CCPHRP). The report envisioned this entity as carrying the mandate for policy development, education, standards setting, and accreditation for research involving human subjects. Here again, an independent body was proposed that could serve in an advisory capacity to the general research community.

HAL (2009) proposed three ways in which the current research integrity system in Canada could be strengthened: (i) an evolution of the current structure; (ii) the introduction of an ombudsperson; and (iii) the formation of a Canadian Office of Research Integrity. The HAL report did not choose among these three options, but made it clear that, regardless of the option chosen, there should be an increased focus on education, information management, and the provision of advice.

In 2002, the Institute of Medicine (IOM) and National Research Council (NRC) Committee on Assessing Integrity in Research Environments released a report entitled *Integrity in Scientific Research: Creating an Environment That Promotes Responsible Conduct* (IOM and NRC Committee on Assessing Integrity in Research Environments, 2002). The report, while not specific to the Canadian situation, comprehensively assessed the Committee's consideration of methods for promoting research integrity, and measured the effectiveness of these efforts. Having considered the available evidence, the IOM and NRC Committee concluded that it was impossible to identify one single approach to promoting and evaluating research integrity.

The Panel's examination of these reports, alongside existing national frameworks, reveals a variety of possible approaches to strengthening the existing Canadian framework and addressing the gaps identified in Table 2.2. The Panel suggests a more comprehensive, multifaceted approach to research integrity, which features the following characteristics:

- a system-wide approach that encompasses all disciplines;
- a common set of definitions, values, and principles that are accepted and implemented by all actors in the research enterprise;
- a fair and timely process for managing allegations of misconduct;
- a centralized mechanism for information management and research on issues related to research integrity; and
- a strong focus on proactive and preventative measures such as education, training, and advice.

In its deliberations on how to best implement this comprehensive approach to research integrity, the Panel narrowed it down to the three main options that are presented briefly below.

Creation of a new legislated body. A legislated body responsible for sanctioning would likely be hindered in its capacity to also effectively carry out the functions of promotion and prevention. Given the scarcity of information on best practices and efficacy, it may be difficult for policy-makers to devise an effective form of legislation. Since legislation tends to be time consuming and sometimes rigid, such a body might not be sufficiently flexible to adapt and modify its approach, as new information and research are collected in the coming years.

Increasing the Tri-Council's educational and advisory role. There was limited evidence to suggest that increasing the Tri-Council's educational and advisory role would produce effective outcomes. Its broad mandate and limited resources, in conjunction with its role in monitoring compliance, would constrain the Tri-Council from serving as an independent advisory body on issues of research integrity.

Introduction of a new actor. The gaps and lack of cohesive force in the existing Canadian policy framework suggest that the formation of a new (non-legislated) independent actor would be required to implement the first two components, promotion and prevention, of a comprehensive, system-based approach to research integrity. Endowing this new entity with an important advisory and educational role would also serve to enhance transparency and accountability.

The Panel concludes that the third option, the formation of a new central body, would best help address the gaps while, at the same time, conserve areas where the current framework is already effective. The proposed new actor, the Canadian Council for Research Integrity (CCRI), would not assume responsibility for the third component of the system-based approach, sanction. That would remain firmly within the Tri-Council's purview, given its existing position within the research landscape and its capacity to impose penalties (e.g., withdrawal/withholding of research funds). Measures must be taken, however, to better manage institutional conflicts of interest, to ensure timely and open due diligence protocols with regard to research misconduct, and to implement methods for dealing with research partners outside of their traditional mandate.

Along with the responsibility for implementing promotion and prevention, the CCRI's other key roles would include (i) the provision of confidential advice; (ii) information gathering; (iii) the dissemination and reporting of information; and (iv) the development and promotion of best practice standards with respect to education, training, and effective self-assessment policies and practices.

Chapter 4 outlines the Panel's proposal for the function and form of the CCRI.

Chapter 4 The Proposed Canadian Council for Research Integrity

As a first step in formulating its vision of the proposed new body, the Panel debated the pros and cons of various existing organizational structures in Canada. This chapter briefly looks at four potential models for the Canadian Council for Research Integrity (CCRI). It also describes a research integrity partnership in which the CCRI would work closely with the other five actors in the research enterprise, and presents a discussion of some of the functional and logistical considerations for the new entity.

4.1 ORGANIZATIONAL MODELS

Specific elements of each of the four models described below could provide helpful guidance in developing the organizational structure of the CCRI.

Canadian Council on Animal Care (CCAC)

This organization was founded in 1968, and incorporated as an independent non-profit body in 1982. The CCAC reports instances of non-compliance with standards of practice for animal care to the Tri-Council, which imposes sanctions when necessary. The CCAC uses a certification scheme and, since 2002, its Certificate of Good Animal Practice (GAP) has been a mandatory requirement in the Memorandum of Understanding between the Tri-Council and all institutions receiving its funds for animal-based research.

The CCAC is mostly funded by "public monies through the Canadian Institutes of Health Research (CIHR) and the Natural Sciences and Engineering Research Council (NSERC), with additional contributions from federal science-based departments and private institutions. While the CCAC operates on an annual budget, it is funded through three-year grants from CIHR and NSERC, allowing the development and implementation of long-term policy" (CCAC, 2010, para. 2). External expert panels chosen by CIHR/NSERC review the CCAC's performance upon grant renewal every three years.

The CCAC provides good insight as an organizational model as it is independent from the Tri-Council, and has gained the respect of the research community. The Panel prefers a supportive role for the CCRI in assisting institutions instead of any type of research integrity certification scheme (e.g., GAP).

Interagency Advisory Panel on Research Ethics/Interagency Secretariat on Research Ethics (PRE-SRE)

The PRE-SRE was created in 2001 as an in-house body of the Tri-Council with responsibility for coordinating the research ethics[20] policy review process, and for assessing compliance with the *Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans* in funded organizations. As outlined in the PRE-SRE's mandate, the governance structure is such that "the activities of the Panel and the Secretariat ensure coherent and comprehensive interaction with researchers, research institutions, research ethics boards (REBs), governmental organizations (GOs) and non-governmental organizations (NGOs), as well as with the public, when appropriate, signalling the Agencies' stewardship responsibility for the development, evolution, interpretation and implementation of the TCPS"[21] (PRE, 2009, Section VI, para. 1). In this way, the PRE-SRE provides oversight, advice, and education in all matters pertaining to the governance of research ethics for projects involving human participants.

The PRE is supported by an Interagency Secretariat on Research Ethics that is funded and staffed by CIHR, SSHRC, and NSERC. The Secretariat "supports the PRE on policy matters, and reports to an Interagency Management Committee (IMC), primarily on interagency administrative and operational matters. CIHR chairs the IMC, provides administrative oversight and facilitates the interagency operations of the Secretariat. The IMC reports to the Interagency Steering Committee on issues and decisions, as appropriate and required" (CIHR, 2010b, Section V.B, para. 3).

The proposed CCRI would effectively build on the structure and research relationships in place under the PRE-SRE model, and would not serve as a replacement.

National Council on Ethics in Human Research (NCEHR)

Established by the Royal College of Physicians and Surgeons of Canada in 1989, NCEHR is incorporated as a non-profit organization with a mission "to provide leadership in advancing the knowledge and practice of the ethical conduct of research involving humans through advice, guidance, and education" to involved parties (NCEHR, 2009a, para. 1). Its main roles are to assist Research Ethics Boards

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[20] In this context, research ethics refers specifically to the ethical conduct of research with respect to human participant protection. This theme is covered by the Panel's understanding of research integrity as an umbrella concept, which also extends to broader aspects of ethical research conduct.

[21] In this context alone, TCPS refers to the *Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans*.

(REBs) in interpreting and implementing guidelines, resolving contentious issues, and monitoring performance. It also has a mandate to "foster education, dialogue and understanding in and among institutions, REBs, researchers, professional personnel, organizations that fund research and the public" (Terms of Reference, #5) and to develop new expertise to meet emerging ethical challenges in research involving human subjects. Finally, NCEHR has been engaged in auditing REBs for adherence to current guidelines. NCEHR activities are primarily sponsored by CIHR, Health Canada, The Royal College of Physicians and Surgeons of Canada, PRE-SRE, and the Office for Human Research Protections (NCEHR, 2009b).

Although NCEHR serves as a good model for delivering educational platforms, there is a clear and present need for focused attention on research integrity to keep Canada aligned with other international initiatives (Campo-Ruiz, 2010; NCEHR, 2010). In the Panel's view, the proposed CCRI would be better suited and designed for this role. The voluntary auditing function for REBs on compliance which NCEHR has taken on over many years is contrary to the proposed approach of the CCRI. The CCRI would be in a position to build on, in a focused manner, the strength of NCEHR experiences to support research integrity coordination and facilitation in Canada.[22]

Canadian Institute for Health Information (CIHI)

CIHI is an independent, not-for-profit organization that provides "data and analysis on Canada's health system, and the health of Canadians" (CIHI, 2006a, para. 1). Its reports, studies, education sessions, and conferences support decision making and planning by governments, hospitals, health authorities, and professional associations. CIHI also provides researchers, the media, and the general public with information about the performance of Canada's health system. Further, CIHI links federal, provincial, and territorial governments with non-governmental health-related groups. CIHI is mainly funded "through bilateral funding agreements with federal and provincial/territorial ministries of health, and individual care institutions. CIHI also receives additional funding for specific projects… A small portion of its revenue is generated through the sale of products" and services (CIHI, 2006b, para. 1).

CIHI provides a valuable model for the proposed CCRI in terms of its advisory and educational roles, and relevant organizational structure.

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[22] The financial resources supporting NCEHR have recently been greatly diminished to the point that its viability is in serious jeopardy (Shuchman, 2010, May 6).

4.2 THE RESEARCH INTEGRITY PARTNERSHIP

For Canada to strengthen its performance in research integrity, there is a need for collaboration and engagement among the five key actors involved in funded research. The proposed Canadian Council for Research Integrity adds a sixth actor, with an important role to play in coordinating, identifying best practices, and providing advice to the other actors.

The Actors

Individual researchers

Academic institutions

The Tri-Council

Other public funders

Private-sector funders

The CCRI

The Panel envisions the role of the CCRI as one of facilitation and support for the other five actors. In this model, academic institutions would be required to submit to the CCRI a regular (perhaps biennial) self-assessment report of their efforts to promote research integrity, along with recommendations on past practices and desirable policy changes. Institutions would access, on a voluntary basis, other services provided by the CCRI. Involvement of the broader research community would be key to the credibility and legitimacy of the CCRI. As an independent central body, it would be in a position to encourage researchers and organizations outside the scope of Tri-Council funding to participate in a Canada-wide system of research integrity.

Wise Counsel from an Advisory Board

Any central body that aims to assist the research community must be set up in a non-threatening way so that individuals will approach it willingly with questions or for assistance. The CCRI's core staff would be supported by an Advisory Board that is knowledgeable, impartial, and recognized for its sound judgment. This Advisory Board would assist the CCRI in guiding the research community in implementing shared research integrity values and principles within an integrated system.

Selecting the Advisory Board

The Advisory Board would be a cross-section of "wise" individuals trusted by the community, including representatives from government and the public at large. The selection process would ensure a balance across all disciplines, and

provide involved parties with an opportunity to propose Board members. The Panel envisions an Advisory Board of 10 to 12 members working as volunteers and meeting on a regular basis.

The Panel considered potential scenarios for the initial appointment and sustainability of the Advisory Board. Bodies such as the three Canadian academies[23] would be well positioned to provide advice in establishing the Advisory Board. Once the initial members were established, the Advisory Board would likely consider succession planning and renewal to create the necessary sustainability for the CCRI to be effective.

The Panel recognizes that input on the part of involved parties will be critical in ensuring buy-in for the CCRI and its Advisory Board, and that close collaboration will be needed with all actors in the research enterprise. The Advisory Board would be responsible for establishing additional committees, both ad hoc and standing, to deal with specific issues.

4.3 FUNCTIONAL AND LOGISTICAL CONSIDERATIONS FOR THE CCRI

Key Roles and Responsibilities

As mentioned at the end of Chapter 3, in order to support a system-wide environment of research integrity, the CCRI would have responsibilities in four key areas: (i) the provision of confidential advice; (ii) information gathering; (iii) the dissemination and reporting of information; and (iv) the development and promotion of best practice standards with respect to education, training, and effective self-assessment policies and practices.

Provision of confidential advice: The CCRI is intended to ensure a supportive, non-threatening environment in which individuals would seek its advice, rather than to create a system focused on singling out and sanctioning misconduct. The CCRI could also fill a key gap in the current system by acting in an advisory role for institutional leaders and funders, such as the Tri-Council, which currently have no one to consult for advice.

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[23] The Royal Society of Canada: The Academies of Arts, Humanities and Sciences of Canada (RSC); the Canadian Academy of Engineering (CAE); and the Canadian Academy of Health Sciences (CAHS).

Information gathering: As previously mentioned, the CCRI would have the authority to require that academic institutions receiving funds from the Tri-Council submit a regular self-assessment report discussing their research integrity policies and practices, including educational, training, and awareness initiatives. Once well-accepted best practices were established, the CCRI could eventually act as a central repository for anonymous self-assessment data. Institutions could access the database and evaluate their own performance in light of the evidence compiled and analyzed by the CCRI. The CCRI could also facilitate the collection of information and its subsequent provision to appropriate audiences, with the potential to incrementally develop a clearing house function.

Dissemination and reporting of information: To effectively share and report information to appropriate involved parties, the CCRI would need to put certain mechanisms into place. Although the specifics of these would need to be worked out in detail, examples could include the following:

- Submission of an annual report on the CCRI's activities to the Tri-Council, which the latter would make public for all actors to assess CCRI initiatives. This report would also educate the community on matters related to research integrity, research misconduct, and the responsible conduct of research. For example, it could identify trends, concerns, success stories, and best practices from across Canada without "naming names."
- Publication of aggregate anonymous data, from self-assessments and other sources, so that institutions could assess how they compare to the broader community.

Promotion of best practice standards: The CCRI could work with the Tri-Council to elaborate on the *Tri-Council Policy Statement on Research Integrity and Scholarship* (TCPS-IRS), the Framework, and relevant schedules of the Tri-Council's Memorandum of Understanding. This could be done via regular meetings between the Tri-Council and the CCRI to substantiate their partnership in the area of research integrity education. The CCRI would work to develop best practices in a variety of areas (e.g., educational/training programs, advice and counselling) with the ultimate goal of encouraging sound research practices, and discouraging and preventing undesirable ones.

To carry out its functions effectively, the CCRI should not play any direct role in policing research misconduct. Issues related to direct oversight, compliance and enforcement, sanctioning authority, and certification or accreditation schemes should not be part of the CCRI's mandate. This separation of policing and

advisory roles differs from the system proposed by stakeholders in Australia where a central, impartial body responsible for enforcement of the Code for the Responsible Conduct of Research is under consideration (see Section 2.1).

The Panel's vision for the CCRI is similar to the role played by the Ombudsperson[24] in the German system. It also echoes recent thinking exemplified by the U.S. Council of Graduate Schools (CGS). The CGS Project for Scholarly Integrity is built on the premise that educational initiatives should be conducted independently from compliance and enforcement efforts. In the words of Daniel Denecke, Director of Best Practices at CGS, the communications strategies around "fear and accountability" should be independent from those promoting "reward and recognition" (Denecke, 2009, slide 10). The formation of an independent body, not involved in sanctioning or enforcement, would create a trusted entity that individuals and institutions could approach for advice without fearing consequences to themselves, or to others.

Logistical Considerations

Ideally, the CCRI would be staffed by an Executive Director, four to five core professional staff, and two to three support staff. This size is in alignment with that of other offices tasked with similar responsibilities (e.g., the educational/advisory division of the ORI). A travel budget would support meetings with various involved parties and Advisory Board travel.

Any source of funding would have advantages and disadvantages, and establishing a transparent, accountable system will be integral to the effective functioning of the CCRI. Recognizing the leadership role that the Tri-Council plays in addressing research integrity at the national level, the Government of Canada could provide new funding for the not-for-profit entity via the federal granting agencies. An arm's length agreement, such as that exhibited by the CIHI model, would help ensure accountability and public trust.

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[24] The Panel did take into consideration that the proposed new body, like an ombudsperson, might come into possession of knowledge that could be reportable under Canadian law. The Panel expects that any such instances would be dealt with in accordance with the appropriate legal frameworks, based on sound legal advice.

Chapter 5 Roles and Responsibilities: An Integrated Approach to Research Integrity

According to the *Tri-Council Policy Statement on Research Integrity and Scholarship* (TCPS-IRS), "the primary responsibility for high standards of conduct in research and scholarship rests with the individuals carrying out these activities" (NSERC, CIHR, & SSHRC, 2009a, Section 1, para. 1). In the context of an integrated system, the Panel has broadened this definition of individuals involved in the production of research and scholarship to reflect all actors within the system. These include not only those who are actively engaged in the conduct of research, but also those responsible for the management and support of the research enterprise: individual researchers, academic institutions, the Tri-Council, other public-sector funders, and private-sector funders. For the CCRI to succeed in building a positive research environment in Canada, it must work closely with these five key actors.

This chapter addresses sub-questions 4 and 5 of the charge to the Panel: the roles and responsibilities of the key actors in the research enterprise (Section 5.1) and, in light of the material presented in this report, how a common research integrity definition could foster a research environment of high ethical standards and instil public confidence (Section 5.2).

5.1 ROLES AND RESPONSIBILITIES IN PROMOTING AN INTEGRATED RESEARCH INTEGRITY ENVIRONMENT

Sub-question 4 of the charge to the Panel asked the following:

In light of a clear definition of research integrity, what are the roles and responsibilities of those involved in research (including researchers, scientists and research and academic institutions funded by Canada's granting councils) to uphold this definition and the key principles and practices, including roles and responsibilities for education?

Each of the five actors in the research enterprise has a responsibility towards ensuring that research in Canada is conducted in such a way as to guarantee the continued support and trust of its various communities (e.g., the general public, private-sector users, and political leaders). The following sections outline the specific roles and responsibilities for each actor vis-à-vis this report's proposed integrated approach to research integrity.

Individual Researchers

Individual researchers play the lead role in research and scholarship, as their actions and endeavours seek to expand the fundamental understanding and knowledge of the world around us. During their formative years, new researchers are exposed to many aspects of professional training, which generally focus on the effective practice of disciplined enquiry.

Academia should tackle not only the issue of how to conduct research effectively, but also how to conduct it responsibly. Traditionally, these efforts have focused on defining specific acts of misconduct that are generally based on a defined set of values and/or principles, as outlined by regulatory or advisory bodies. Researchers obtain a clear set of parameters that constitute the responsible conduct of research when provided with a list of actions that are considered to violate the shared set of values and principles. Steneck (2002) suggested that this approach is inadequate because, although it provides researchers with instructions on how to act, it does not give them a sufficient understanding of why these actions are important. This, in turn, results in a reduced capacity on the part of researchers to deal with "gray area" situations where there may be cases of conflicting values.

Focus group data from the United States have suggested that everyday problems faced by researchers often reflect the challenges of working on the "frontier of knowledge" (de Vries *et al.*, 2006, p. 44). New technology, and the generation of new knowledge, have raised difficult questions about the interpretation of data, the application of rules, and social relationships (de Vries *et al.*, 2006). Researchers also have a responsibility to apply the same values and principles that guide research conduct to the performance of related professional tasks. Many researchers, upon reaching more senior positions in their academic careers, take on additional leadership responsibilities within the research community (e.g., advisory committee roles, public lecturers, journal editors, peer reviewers) (see Box 5.1).

The Panel believes that researchers should be responsible for conducting themselves, and their professional activities, according to the five core values and 11 fundamental principles outlined in Chapter 3 of this report. Researchers should also be properly trained and supported in how to effectively handle situations involving conflicting values. In return, they should be responsible for the proper training and development of their research teams (e.g., students, supporting research staff) in the responsible conduct of scientific enquiry.

Box 5.1 The Role of Journal Editors

Increasing attention is being paid to the roles and responsibilities of journal editors in upholding research integrity and reporting misconduct (Smith, 2006; Marusic, Katavic, & Marusic, 2007). Their predominance in communicating research results means they also have a central role to play in upholding research integrity. As a result of the SWOT analysis, an audit of the (S)trengths, (W)eaknesses, (O)pportunities and (T)hreats facing journal editors in their role as research integrity monitors, Marusic *et al.* (2007) concluded that the absence of legal authority and lack of training prevent editors from serving in a policing capacity. Their independence, expertise, and general responsibility for upholding the research record, however, holds them ultimately accountable for vigilance against, and reporting of, any acts of misconduct within their journals.

Similarly, Smith (2006) called on his own experience as editor of the *British Medical Journal* to underscore the important role of editors in ensuring the highest ethical standards within the publishing community.

The Panel concurs with the views of Smith and Marusic *et al.*, and supports the assertion that journal editors have a key role to play in ensuring compliance with good research practices as well as detecting and reporting research misconduct. To this end, editors should work with organizations, such as the Committee on Publications Ethics (COPE), for training in the identification of misconduct, and advice on appropriate protocols for taking action.

Academic Institutions

Institutional leaders and research administrators have a critical role to play in establishing a positive research integrity environment. As links between funding providers and individual researchers, they serve as a supporting entity to both groups.

Institutions should be responsible for deciding how to best integrate the values and principles expressed in this report into their own activities including, for example, the way in which they educate and monitor their staff's activities, and the ideals that guide the goals and objectives of their research-related activities (e.g., fundraising). Leaders and staff in Canadian institutions should be responsible for promoting

and maintaining an environment of high ethical standards in the following four areas: (i) awareness and incentive creation; (ii) training and capacity building; (iii) infrastructure and staff support; and (iv) policy development and implementation.

Awareness and Incentive Creation: Institutional administrators should exercise strong leadership by speaking out on the importance of, and requirement for, research integrity within their institutions, research centres, faculties, and departments. By clearly promoting the five core values, management could establish high expectations for the responsible conduct and management of research. Additionally, administrators should encourage regular discussions on research integrity within groups such as the Board of Governors, the Senate, faculty, and academic units and their equivalents, so as to ensure an ongoing awareness of an institution's commitment to the highest ethical standards. Finally, institutional leaders should seek out and provide incentives for the promotion, administration, enactment, and monitoring of research integrity within their organizations.

Training and Capacity Building: Institutions should be responsible for ensuring that the individual capacities of all their research community members and administrative staff meet the personal responsibilities (as defined in the Individual Researcher Section) regarding research integrity. Administrators should support the education and training of faculty, staff, and students/trainees in an institution's research integrity policies and practices. Furthermore, they should ensure accessibility to the expertise and functional support that is needed at both the individual researcher/team and the broader institutional levels. The competence of researchers and research staff in responsible research conduct should be a clear priority in institutional hiring processes, training, and professional development. To implement the Panel's vision, institutions must work effectively with the CCRI to learn about, and enact, best practices for education, training, and research integrity policies.

Infrastructure and Staff Support: Institutions should provide the physical and human resources required to effectively support researchers in the maintenance of files, data, information, and other materials, as well as the management and reporting of financial information. This support could include staff allocation, lockable cabinets, appropriate office space, and computer security.

Policy Development and Implementation: As the primary overseers of compliance with the TCPS-IRS, administrators should develop, implement, and update research integrity policies and practices that are consistent with both the TCPS-IRS and the values and principles outlined in this report. Management should commit to annual self-assessments and progress monitoring of research integrity objectives. On a more practical level, institutional leaders and managers should put in place mechanisms for dealing with potential conflicts of interest arising from such issues as external sources of funding, including private companies and government departments/agencies. Furthermore, they should diligently investigate and take action on allegations of research misconduct in such a way as to maintain trust within the research community and the public at large.

The Tri-Council

Funding at Canadian public research institutions stems primarily from the Tri-Council, which, the Panel maintains, should retain its primary leadership role on issues of research integrity. In support of this role, and to more clearly define specific responsibilities, three areas have been identified where Tri-Council leaders and staff should be responsible for promoting and maintaining an environment of high ethical standards: (i) awareness and training; (ii) policy development; and (iii) oversight, sanctioning, and reporting on misconduct allegations.

Awareness and Training: The Tri-Council should continue to be vocal about the importance of research integrity. By regularly raising the issue with governing bodies and responsible ministers, the Tri-Council could encourage awareness and provide education. Its internal commitment to staff training, and the integration of research integrity core values and principles in internal policies and practices, should reflect this awareness and education. The Tri-Council should be supportive of the CCRI, and assist the new entity in becoming an effective partner through developing best practices, supporting education and training, and providing advice on all aspects of research integrity.

Policy Development: To ensure the most up-to-date and relevant approaches to research integrity, the Tri-Council should make an ongoing commitment to expand and clarify the TCPS-IRS, the Framework, and relevant sections of the Tri-Council MOU with eligible institutions. This should include the provision of clearly stated standards and expectations for researchers and institutions receiving concurrent funding from external sources.

Oversight, Sanctioning, and Reporting on Misconduct Allegations: The Tri-Council should continue to monitor the compliance of various recipient institutions with its research integrity policies and Framework. To this end, specially trained staff should conduct regular research integrity audits, paying particular attention to institutional research integrity policies, education programs, and monitoring practices. In monitoring compliance with the research integrity Framework, institutions should be encouraged and assisted in the fulfilment of their self-assessment responsibilities.

The Tri-Council should also be mindful of those factors viewed as particularly damaging to public trust. Media attention on specific allegations of misconduct in Canada has highlighted the perception that investigations are too lengthy, and that processes to deal with wrongdoers lack transparency. Upon notification of alleged research misconduct, the Tri-Council should ensure a timely response by the institutions in question.

Recognizing that federal and provincial privacy legislation is partly responsible for the perceived environment of secrecy, the Panel urges the Tri-Council to work with government, universities, and other involved parties to enhance transparency surrounding research integrity and research misconduct issues. In particular, the Tri-Council could consider mechanisms and propose changes in legislation that would allow the disclosure of the names of researchers and institutions that have been convicted of breaching Tri-Council policy on the basis of a fair and balanced process. To demonstrate to the public how seriously the Tri-Council and the institutions view such breaches, any disclosure should also reveal the details of any sanctions imposed. This approach would help to retain peer, stakeholder, and public confidence in the overall research integrity system.

Other Public-Sector Funders and Private-Sector Funders

The Panel recognizes that the Tri-Council is not the only funding mechanism available to Canadian researchers. Contributions from other funding sources (e.g., the provinces, federal and provincial agencies, and private-sector funders (non-profit foundations/industry)) constitute a significant portion of research budgets, particularly in the case of Canada's most research-intensive universities. Recent changes in the research landscape and federal priorities have also resulted in a rise in the number of partnerships between universities and the private sector. These changes have further complicated the division between public and private sources of funding.

When providing research funding to Tri-Council grant recipients, private- and public-sector funders, other than the Tri-Council (e.g., provinces, federal and provincial agencies, non-profit foundations), should support research integrity by:

- respecting the independence and autonomy of researchers in determining research objectives, methodology, and reporting;
- respecting the right of institutional researchers to publish the findings of their work in a timely way;
- respecting the definition and key elements of research integrity as set out by this Panel; and
- working with researchers and institutions to ensure that the protection of prior intellectual property held by a private company goes hand in hand with the rights of researchers to publish and publicly communicate their findings (i.e., all parties need to find a fair balance).

The responsibilities outlined above for the Tri-Council and other funders represent the Panel's consensus opinion on the key requirements surrounding funding practices. These requirements would uphold the values and principles presented in this report, and contribute to the development of an integrated and positive research integrity system.

5.2 CONCLUDING REMARKS

The final sub-question in the charge asked: *How could a common research integrity definition foster a research culture of high ethical standards and instil public confidence*? To answer this question, the Panel considered all the evidence and material presented within this report, in particular the material in Chapters 1 and 2.

Chapter 1 outlined the importance of research as an intellectual endeavour, and the need for public trust in the enterprise to ensure its continued support. It then postulated that this support could only be sustained in an environment where all members of the research community were held to the highest standards of research integrity. Yet, many existing factors threaten both the responsible conduct of research and public confidence in research activities and results.

Chapter 2 demonstrated the great importance of research integrity issues at both the international and national levels; yet, no commonly accepted approach or definitions exist among the dozens of research integrity systems around the world. The existing Canadian framework, while relatively effective, lacks a common definition that can be applied across all institutions. The differing approaches within Canadian universities have led to the perception, among the general public,

politicians, media, and other involved parties, of inequities and inefficiencies. The framework's positive aspects are often not visible to outsiders, nor to researchers themselves.

The Panel concludes that while a common definition of research integrity is important, it is only one component of fostering an environment of high ethical standards and public trust.

In the existing framework, even a universal definition would still be subjected to inconsistent interpretation by individual institutions. This, in turn, could lead to the inconsistent application of the definition within that research community. Rather, the Panel has proposed that what is required is not only a common definition, but also a shared set of values and principles that govern all actors who conduct, manage, and fund research in Canada. These stated values and principles should then be developed into practical guidelines and best practices to direct the construction and implementation of a national, proactive approach to research integrity.

The broad mandate and limited resources of the Tri-Council, in conjunction with its role in monitoring compliance within the research integrity framework, would constrain the Tri-Council from serving as an independent advisory body on issues of research integrity. Therefore, the Panel has proposed the formation of an independent body, the Canadian Council for Research Integrity (CCRI), which would serve all members of the research community, and function as a much-needed educational/advisory arm on issues of research integrity. Its key role would be to build and promote a proactive approach to research integrity in Canada.

The CCRI would focus on education and best practices with the ultimate goal of developing a standardized and concerted approach to research integrity in Canada. The CCRI would increase the visibility of research integrity among all involved parties and enable leaders at all levels to highlight its importance. The independence of the CCRI, and its lack of sanctioning authority, would provide a non-threatening entity where researchers, managers, and funders alike could

seek advice and guidance on issues of ethical research conduct. The CCRI would be an impartial, trusted authority that could focus attention on research integrity issues, without any real or perceived conflicting interests. The responsibilities of the CCRI, as proposed by the Panel, would address and fill the identified gaps in information management and research, as well as in education, training, and mentoring.

The Panel's findings and conclusions reflect the emerging belief that the ethical conduct of research requires a concerted effort on the part of all actors in the research community, rather than simply a focus on individual behaviours and institutional responses. Researchers, managers, and funders must commit to a common definition and a shared set of values and principles that will foster a positive research integrity environment throughout the country. Supported and facilitated by the CCRI, the research community would then be able to manifest the highest ethical standards and, consequently, ensure public confidence in the research enterprise.

Key Findings

- Canada must address the gaps in the existing research system that are undermining the system's transparency and accountability.
- Canada needs a common, system-wide approach to research integrity that involves all actors.
- There is a need to foster a positive, values-based environment for research integrity in Canada.
- Canada needs a new entity, the Canadian Council for Research Integrity, to serve as a central educational and advisory arm on issues of research integrity.

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Appendix A Members of the Canadian Research Integrity Forum

- Association francophone du savoir (ACFAS)
- Association of Canadian Academic Healthcare Organizations (ACAHO)
- Association of Faculties of Medicine of Canada (AFMC)
- Association of Universities and Colleges of Canada (AUCC)
- Canadian Association of University Research Administrators (CAURA)
- Canadian Association of University Teachers (CAUT)
- Canadian Federation for the Humanities and Social Sciences (CFHSS)
- Canadian Health Services Research Foundation (CHSRF)
- Canadian Institutes of Health Research (CIHR)
- Federal Assistant Deputy Minister S&T Integration Board
- Health Canada
- Kevin Keough Consulting Inc.
- Michael Smith Foundation for Health Research (MSFHR)
- National Council on Ethics in Human Research (NCEHR)
- Natural Sciences and Engineering Research Council (NSERC)
- Public Health Agency of Canada (PHAC)
- Social Sciences and Humanities Research Council (SSHRC)

The Council of Canadian Academies participated in the 2009/10 Canadian Research Integrity Forum (CRIF) discussions as an observer.

Appendix B NSERC, SSHRC, and AUCC Recommendations to Strengthen the Existing Research Integrity Framework

The report[26] recommended that the existing research integrity framework be strengthened in four main areas:

Examining the roles, responsibilities, and authorities of NSERC and SSHRC

- NSERC and SSHRC to examine the scope and limits of their legislated role, responsibilities and authority, consider the implications of other relevant legislation (Privacy Act and provincial legislation), and recommend legislative changes to the Minister of Industry, if necessary; and
- NSERC and SSHRC committed to ensuring "full accountability of researchers, agencies and institutions" (Implementation: Does it Work?, Issues and Planned Actions, Action #6) within their legislated limits by strengthening the agencies' integrity framework, which encompasses a number of integrity-relevant documents.

Strengthening the current research and scholarly integrity policies through clarification

- Consensus definitions of misconduct and all related "concepts such as plagiarism and consistent language, greater clarity and precision in policy" language (Research and Scholarly Integrity Policy: Is it adequate?, Issues and Planned Actions, para. 4);
- Improved clarity of roles and responsibilities;
- Realistic, standard timeframes and reporting protocols "to be followed by both agencies and institutions" (Summary of Planned Actions, Action 2, point 4);
- "Duty to report" suspicions of misconduct, and requirements for whistleblower protection;
- NSERC and SSHRC to prepare annual reports on misconduct involving agency-funded research, and institutional publication of the same;
- Regular research integrity policy review and revision at the institutional level; and
- Solicitation of CIHR's commitment and participation in all of the above.

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[26] This appendix summarizes the recommendations of the report *Review of NSERC's and SSHRC's Policy Framework for Research Integrity* (NSERC, SSHRC, & AUCC, 2008).

Improving policy effectiveness and increasing its transparency

- Communicate regularly with institutions regarding responsibilities and best practices;
- Develop and make publicly available a consistent approach to processes, including receiving and transmitting allegations and sanctions, and tracking and consolidating data;
- Determine which cases should be referred to legal authorities;
- Identify measures to share information between institutions and/or the public, consistent with appropriate federal and provincial laws;
- Work with the AUCC, institutions, and partner organizations to promote an overall culture of research integrity through education and consultation; and
- Solicit CIHR's commitment and participation for the long-term development of a formal "process to rectify the research record following findings of misconduct" (Issues and Planned Actions, Action #2).

Long-term recommendations to update and strengthen financial policies as a means to ensure accountability and provide "increased clarity of terms, roles and responsibilities" (*Summary of Planned Actions, Action #4*)

- Standardize procedures for managing allegations of misuse of grant funds and disseminate these publicly;
- Clarify the types of cases concerning misuse of agency funds that must be investigated, and the necessary sanctions that will be imposed when financial misconduct is found; and
- With AUCC, institutions, and partner organizations such as the Canadian Association of University Business Officers (CAUBO), "enhance education and promotion of the highest standards of financial accountability" (Financial Accountability- Issues and Planned Actions, Action #4).

Appendix C Stakeholders Invited to Address the Panel

The Expert Panel on Research Integrity heard from the following key stakeholders:

- Glenn Brimacombe, CEO, Association of Canadian Academic Healthcare Organizations, Ottawa, ON
- Dianne Caldbick, Director, SSHRC liaison, Science and Innovation Sector, Industry Canada, Ottawa, ON
- Barbara Conway, Corporate Secretary, Natural Science and Engineering Research Council; Chair, Tri-Council Working Group on Research Integrity, Ottawa, ON
- Carole Crête-Robidoux, Corporate Secretary, Social Sciences and Humanities Research Council, Ottawa, ON
- Tijs Creutzberg, Principal, Hickling Arthurs Low, Ottawa, ON
- Paul Davidson, President, Association of Universities and Colleges of Canada, Ottawa, ON
- Rob Dunlop, Assistant Deputy Minister, Science and Innovation Sector, Industry Canada, Ottawa, ON
- Paul Jones, Policy & Education Officer, Canadian Association of University Teachers, Ottawa, ON
- Peter Lewis, Acting VP Research, University of Toronto; Association of Universities and Colleges of Canada representative, Toronto, ON
- Jim Madder, EVP Academic, Red Deer College, Red Deer, AB; representative of the Association of Canadian Community Colleges, Ottawa, ON
- Christopher Paige, VP Research, University Health Network, Toronto, ON; ACAHO representative
- Tina Saryeddine, Assistant VP, Research & Policy Analysis, Association of Canadian Academic Healthcare Organizations, Ottawa, ON
- James Turk, Executive Director, Canadian Association of University Teachers, Ottawa, ON
- Lindsay Walker, Policy Analyst, SSHRC liaison, Science and Innovation Sector, Industry Canada, Ottawa, ON
- Karen Wallace, Ethics Policy Advisor, Research Integrity, Canadian Institutes of Health Research, Ottawa, ON

Appendix D International Research Integrity Governance Systems

Country	Title	Source
Australia	Australian Code for the Responsible Conduct of Research	Australian Government, 2007
	DRAFT – Proposal to Establish an Australian Research Integrity Committee	NHMRC, ARC & Department of Innovation, Industry, Science and Research, 2009
China	Opinions on Strengthening Research Integrity of Our Country	Joint Committee for Promoting Research Integrity, 2009
Croatia	CESHE Ethics Code	Committee for Ethics in Science and Higher Education, 2006
Czech Republic	Code of Ethics for Researchers of the Academy of Sciences of the Czech Republic	Committee for Scientific Integrity, 2006
Denmark	Annual Review 2008	Danish Committees on Scientific Dishonesty, 2008
	The Danish Committees on Scientific Dishonesty	Danish Agency for Science Technology and Innovation, 2009
Estonia	Code of Ethics of Estonian Scientists	Estonian Academy of Science, 2002
Finland	Good Scientific Practice and Procedures for Handling Misconduct and Fraud in Science	National Advisory Board on Ethics, 2002
Germany	Proposals for Safeguarding Good Scientific Practice	Deutsche Forschungsgemeinschaft, 1998
	Rules of Good Scientific Practice	Max Planck Society, 2000a
	Rules of Procedure in Cases of Suspected Scientific Misconduct	Max Planck Society, 2000b
Latvia	Scientist's Code of Ethics	Latvian Council of Science, 1997
Netherlands	Notitie Wetenschappelijke Integriteit (Scientific Integrity Memorandum)	National Board for Scientific Integrity, 2001
Norway	Act of 30 June 2006 No. 56 on Ethics and Integrity in Research	The National Committees for Research Ethics, 2006
Poland	A Set of Principles and Guidelines (Third ed.)	Polish Academy of Sciences Committee for Ethics in Science, 1994
Sweden	Good Research Practice – What is it? Views, Guidelines and Examples	The Swedish Research Council, 2005

Country	Title	Source
Switzerland	Integrity in Scientific Research: Principles and procedures	Swiss Academies of Arts and Sciences, 2008
	Statement of SNF Position on Scientific Misconduct	Swiss National Science Foundation, 2005
United Kingdom	Natural Environment Research Council Ethics Policy	Natural Environment Research Council, n.d.
	RCUK Policy and Code of Conduct on the Governance of Good Research Conduct	Research Councils UK, 2009
	UKRIO Code of Practice for Research: Promoting Good Practice and Preventing Misconduct	UKRIO, 2009
United States	Our Mission, Vision, and Values	NSF Office of Inspector General, 2009
	Definition of Research Misconduct	DHHS Office of Research Integrity, 2009

Appendix E Canadian Institutional Policies

Although research integrity and misconduct policies within Canadian institutions differ in many respects, there are important similarities at a general policy level. At a philosophical level, several conceptual premises emerge that link all research integrity and misconduct policies together:

- All policies, whether explicit or implicit, make some reference to the concept of natural justice: impartiality of process and judgment; respect for due process (i.e., fair hearings); adherence to a timely investigation; and protection of the reputation and privacy of both the respondent/accused and complainant/accuser.
- Most policies acknowledge a distinction between honest mistakes and disagreements of interpretation, and carelessness and negligence on the one hand, and intentional academic dishonesty on the other. Honest mistakes and ambiguities of interpretation are unavoidable features of the pursuit for new knowledge, and should not be considered misconduct in research.
- Most policies are malleable in their application, which allows the concept of scholarly misconduct to be applied flexibly across widely differing research environments.

Although some of the policies borrow procedure verbatim from Tri-Council policies, most differ on matters of detail, especially with regard to protocols for dealing with allegations of research misconduct. For the most part, however, similar policy frameworks govern the integrity policies of Canadian institutions. For example, the procedures involved in dealing with complaints of research misconduct typically contain the following characteristics:

- Individual researchers are responsible for meeting standards of scholarly integrity. In some instances, special duties are assigned to principal investigators who have responsibility for overseeing the research of their staff and students, and retaining data and documentation pertaining to the research process.
- The policies allow for some degree of informal advice for those individuals who suspect scholarly misconduct: roughly half of the institutions surveyed explicitly acknowledge that allegations may come from sources internal or external (including the general public) to the institution. In these instances, a senior academic administrator (e.g., a Vice-President/Principal (VP) of Research or Dean) helps achieve the informal resolution of allegations. Most institutions prefer not to pursue a formalized process of investigating scholarly misconduct if it can be avoided.

- If informal channels do not result in a satisfactory resolution, complainants are required to submit a written, signed, and dated formal complaint to the VP or Dean. This complaint must contain sufficiently detailed evidence and documentation to permit an assessment of the merits of the allegation; however, what is considered sufficient detail can vary from institution to institution. In general, anonymous allegations are not pursued unless the evidence is compelling and there is reason to believe that the allegation may subject the complainant to some form of jeopardy. All policies are very clear that unfounded and malicious allegations are also a form of misconduct.

The procedures associated with a formal complaint of scholarly misconduct follow all or many of the following steps:

1. The VP or Dean first evaluates the plausibility of a complaint and the strength of evidence. At this stage, the VP may dismiss the claim.
2. The VP or Dean may appoint an Inquiry Committee composed of individuals with appropriate scholarly background and experience to either determine the plausibility of a complaint or to examine evidence in order to determine if a formal investigation is warranted. An allegation may be dismissed at this phase.
3. If the VP, Dean, or Inquiry Committee deems that an investigation is warranted, an Investigation Committee composed of individuals not on the Inquiry Committee is appointed to evaluate existing evidence, gather new evidence, interview the respondent or complainant and any other relevant parties, and, if necessary, seek expert third party counsel. Often an executive of the institution's faculty association sits on this committee as a participating, but non-voting, member. All proceedings at this stage are fully recorded, and the respondent and complainant are fully informed of the progress of this committee.
4. At the conclusion of the investigation, the Investigation Committee produces a final report that includes the full allegation, supporting documents/witnesses, a ruling, and recommendations on disciplinary action.
5. The VP or President governs the imposition of discipline.
6. An appeal process on the part of the respondent either follows the institution's collective agreement or is made directly to the VP or President.

Appendix F Policies and Codes of Conduct from Canadian Post-Secondary Institutions Consulted by the Panel

Sampling methodology: All institutions from the 13 largest research-intensive universities in Canada (G13) were included. A random number generator was utilized to augment this set with at least one university from each province, six colleges from outside Quebec, and three colleges from within Quebec.

Institution	Policies/Codes of Conduct	Source
Centennial College	Procedures for Responding to Inquiries Related to Integrity	Centennial College, 2005
Collège Shawinigan	Politique d'intégrité sur la recherche	Collège Shawinigan, 2009
Dalhousie University	Policy on Integrity in Scholarly Activity	Dalhousie University, 2001
Lethbridge College	Integrity in Research and Scholarship	Lethbridge College, 2008
McGill University	Policy on Safe Disclosure	McGill University Board of Governors, 2007
	Regulations Concerning Investigation of Research Misconduct (Revised)	McGill University Board of Governors, 2008
McMaster University	Research Ethics at McMaster University	McMaster University, 1993
Memorial University	Policy Statement on Integrity in Scholarly Research	Memorial University, 2001
Niagara College of Applied Arts and Technology	Research Integrity	Niagara College of Applied Arts and Technology, 2004
Ontario College of Art and Design	Research Ethics Policy Overview	Ontario College of Art and Design, 2004
Polytechnique Montréal	Politique relative à l'intégrité et aux conflits d'intérêts en recherche	L'École Polytechnique, n.d.
Queen's University	Academic Integrity Policy Statement	Queen's University, 2006
	Senate Policy on Integrity in Research	Queen's University, 2009
Rimouski CÉGEP	Politique d'intégrité en recherche	CÉGEP de Rimouski, 2002
Saskatchewan Institute of Applied Science and Technology	Applied Research Integrity	SIAST, 2008
Sherbrooke CÉGEP	Politique d'intégrité en recherche	CÉGEP de Sherbrooke, 2009

Institution	Policies/Codes of Conduct	Source
University of Alberta	Conflict Policy – Conflict of Interest and Commitment and Institutional Conflict	University of Alberta, 2002
	University of Alberta Research and Scholarship Integrity Policy	University of Alberta, 2004
University of British Columbia	Research	University of British Columbia Board of Governors, 1995
	Scholarly Integrity	University of British Columbia Board of Governors, 2005
University of Calgary	Research Policy	University of Calgary, 1977
	Integrity in Scholarly Activity Policy	University of Calgary, 1995
Université Laval	Politique sur l'intégrité en recherche et création et sur les conflits d'intérêts	Université Laval, 2009
University of Manitoba	University of Manitoba Policy on Academic Fraud	University of Manitoba, 1991
Université de Moncton	Politique d'intégrité en recherche	Université de Moncton, 2000
University of Montréal	La performance scientifique et l'intégrité en recherche	Godard & Lévesque, n.d.
	Pour une intégrité en recherche	Audy, 2002
	Politique de l'Université de Montréal sur la probité intellectuelle en recherche	Université de Montréal, 2004
	Rapport sur les conflits d'intérêts à l'Université de Montréal: éthique, pratiques et politiques	Couture, Smith, & Williams-Jones, 2007
	Guide de présentation et d'évaluation des mémoires et des thèses de doctorat	Université de Montréal, 2009
University of Ottawa	Conflict of Interest - Members of Staff	University of Ottawa, 2009
Université du Québec	La politique-cadre d'intégrité en recherche	Université du Québec, n.d.
Université du Québec à Montréal (Télé-Université)	Politique relative à l'intégrité en recherche	UQÀM, 2007
University of Prince Edward Island	Integrity in Research and Scholarly Work Policy	University of Prince Edward Island, 2006

Institution	Policies/Codes of Conduct	Source
University of Saskatchewan	Misconduct in Scholarly Work	University of Saskatchewan, 1993
Université de Sherbrooke	Politique, règles et procédures sur l'intégrité en recherche et sur les conflits d'intérêts	Université de Sherbrooke, 2006
University of Toronto	Policy on Ethical Conduct in Research	University of Toronto Governing Council, 1991
	Code of Behaviour on Academic Matters	University of Toronto Governing Council, 1995
	Framework to Address Allegations of Research Misconduct	University of Toronto, 2006
	Publication Policy	University of Toronto Governing Council, 2007
University of Waterloo	Integrity in Research Administrative Guidelines	University of Waterloo, 1994
	A Guide for Graduate Research and Supervision at the University of Waterloo	Waterloo Graduate Studies Office, 2007
University of Western Ontario	Policy and Procedures for the Conduct of Research	University of Western Ontario, 2008

Appendix G Key Canadian Reports Consulted by the Panel

Title	Mission/Context	Conclusions	Source
Integrity in Scholarship: A Report to Concordia University	This Independent Committee of Inquiry was appointed by the Concordia Board of Governors to investigate university policies, practices, and standards pertaining to academic and scientific integrity, and their relation to those of other Canadian universities. It was also charged with investigating certain specific allegations of conflicts of interest, and breaches of scientific and academic integrity made by Dr. V.I. Fabrikant.	Determined that a "production-driven research culture" is the consequence of inherent values in the assessment and reward of scholarly accomplishment across the research landscape. Standards used for resource allocation, hiring, promotion, tenure, merit pay, and honours are founded in criteria that can encourage misconduct, and the depth and ubiquity of this culture makes it resistant to easy change.	Arthurs, *et al*., 1994
How to Ensure Ethics and Integrity Throughout an Organization	This report was a response to recent "high-profile scandals" and the fundamental organizational concern that employees act ethically. New institutions and legislation in the public sector (Public Sector Integrity Commissioner) provided a catalyst.	What Doesn't Work: Exclusive focus on either compliance or ethics; excessive negativity; failure to connect ethics with organizational effectiveness or other divisions within the organization; and failure to emphasize ethics and integrity through all levels of management. What Does Work: Balancing compliance and ethics; linking ethical decisions to organizational value creation and protection, and concrete examples relevant to the line of business; relating integrity to business goals (i.e., reputation, effective recruiting, or meeting customer expectations; ensuring all levels of management reflect ethical action; incorporating ethical considerations into performance reviews; and linking ethics offices with other organizational branches).	Conference Board of Canada, 2008

Title	Mission/Context	Conclusions	Source
Lessons from the Fabrikant File: A Report to the Board of Governors of Concordia University	This report is "an independent review of the employment history of Valery Fabrikant at Concordia University, with particular emphasis on concrete measures to enhance the future ability of the University to deal with a wide range of issues raised by the case in question."	Analyzed the university milieu in which the Fabrikant situation unfolded, and made several recommendations pertaining to institutional structure and governance. Pertinent examples included emphasizing management skill and training in choosing administrators; collectively engaging the whole management structure in important or potentially controversial decisions; and streamlining management structure to bring the upper administrators closer to the actual workings of the university that they oversee.	Cowan, 1994
Moving Ahead: Final Report	The National Council on Ethics in Human Research (NCEHR) and a huge "Sponsor's Table" of stakeholders convened an expert committee "to provide expert advice on the development of a system for human research participant protection in Canada, considering accreditation and alternative models, and taking into account different levels and types of risk in research. This process will include an assessment of existing means of ensuring human research participant protection for various types of research and of the gaps that such a system would address."	Mapped a comprehensive system of research participant protection in Canada, and advocated forming the Canadian Council for the Protection of Human Research Participants (CCPHRP) responsible for accreditation, policy, and education.	Experts Committee for Human Research Participant Protection in Canada, 2008
Faculty Participation in Research at Canadian Colleges: A National Survey	Canadian Council on Learning supported a study on the shift in the "traditional mandate of Canadian colleges (to provide career-related education)" with a view to developing research capacity and culture (due largely to federal initiatives promoting innovation) from a faculty perspective. It sought to define: • the attitudes towards research reported by faculty; • the areas of research interest reported by faculty; and • the barriers and incentives to participation reported by faculty.	The majority of Canadian college faculty members perceive research at their colleges positively, and are interested in participating in it. Faculty are most interested in three primary areas of research: "curiosity-driven research, research related to teaching and learning, and applied research. Major obstacles include lack of release time and, to a lesser extent, limited funds."	Fisher, 2008

Title	Mission/Context	Conclusions	Source
The State of Research Integrity and Misconduct Policies in Canada	Captured in the main text of the report.	Captured in the main text of the report.	HAL, 2009
Summative Evaluation of the Interagency Advisory Panel and Secretariat on Research Ethics (PRE-SRE)	This study was commissioned by the three granting agencies and the interagency management committee to evaluate the relevance, effectiveness, and success of PRE-SRE in reaching agency objectives and promoting high ethical standards of conduct in research in accordance with the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans*.	The study determined that there was strong support for the relevance of PRE-SRE's mandates, but less enthusiasm for its structure. It was tardy in meeting its obligation to evolve and correct the TCPS, and is not well known to the researcher community. Recommendations included greater emphasis on productivity, the need for an open and collaborative approach to working with research ethics policy, education and governance organizations, and better communications with research community stakeholders regarding TCPS stewardship.	Natalie Kishchuk Research & Evaluation Inc. & Gauthier, 2009
Review of NSERC's and SSHRC's Policy Framework for Research Integrity	Captured in the main text of the report.	Captured in the main text of the report.	NSERC, SSHRC, & AUCC, 2008
An Examination of Research Integrity Issues Pertaining to Memorial University of Newfoundland	This report was commissioned to analyze Memorial University's research integrity policies, processes, and initiatives from the early 1990s, including those pertinent to recent allegations of scientific misconduct, and to compare these with those of other Canadian research universities. This led to recommendations to strengthen research integrity at Memorial and for appropriate action to be taken at the national level.	Found that university research integrity policies are based in existing national standards, and that legal council is valuable to university investigatory bodies in cases of research misconduct. The report recommended that ALL accusations of scientific misconduct must be fully investigated, raw data must be retained in a central repository and clinical trials registered, better research integrity leadership must be provided within universities, effective appeal mechanisms and whistleblower protection measures must be in place, and	Pencharz, 2007

Title	Mission/Context	Conclusions	Source
		dialogue must be maintained with the editors of major journals. It also called for the creation of a Research Integrity Agency at the national level to share experiences and information, avoid conflicts of interest, and "allow for objective and fair investigation of an accusation of scientific misconduct." Ideally, this would be an independent body with judicial experience after the Danish model.	
Report of the Committee of Inquiry on the Case Involving Dr. Nancy Olivieri, the Hospital for Sick Children, the University of Toronto, and Apotex Inc.	This report was produced in response to increasing pressure on academic researchers to seek corporate sponsorship in the mid-1980s and 1990s, and the inadequacy of existing institutional policy infrastructures to protect public interest in this new context. Basically, investigator contracts could include provisions that protected sponsor interests but not those of the public or trial subjects, leading to the possibility that a sponsor's contractual rights could conflict with legal and ethical obligations, and academic freedom. This particular case had to do with the freedom to transmit risk information to clinical subjects against sponsor wishes, and the long and tortuous legal and procedural wrangling that followed.	After sorting out the particulars of the case, including proper allocation of responsibility, the report called for measures to ensure that public interest is protected during the conduct of clinical research. This includes a robust role for research ethics boards, a call for the Association of Universities and Colleges of Canada (AUCC) to develop an industry-academy relationship policy, and the charge to Tri-Council to insist that institutions receiving funding from them adhere to strict risk disclosure practices. It also recommended government legislation to ensure transparency and independent inquiry, and regulation of the pharmaceutical industry.	Thompson *et al.*, 2001
Recherche, intégrité et éthique: À aborder distinctement mais conjointement	Written by the ARC (Association pour la recherche au collégial), this paper discusses the advantages for Colleges in adopting a policy on research integrity and ethics. It also proposes steps and tools for the elaboration of such policies.	The ARC, following a consultation with numerous colleges, sought to guide these institutions in the development of their own research policies. Ultimately, the ARC will facilitate this process by developing several activities and networks	Association pour la recherche au collégial, 2007

Title	Mission/Context	Conclusions	Source
Pour une intégrité en recherche: Pour le Comité de liaison en éthique de la recherche de l'UdeM (CLERUM)	A University of Montréal initiative that defines both research integrity and its opposite concept, this paper also attempts to identify the major failures in achieving research integrity, and discusses the elements required to develop research integrity policies.	In attempting to develop a clear definition of research integrity (and conversely research lacking integrity) the complexity of research integrity is quite evident, where integrity is the responsibility of all those implicated in research. The report concluded that research integrity is best served by a collective awareness, where continuing education constitutes a way to promote integrity in research.	Audy, 2002
Le Plan d'action ministériel en éthique de la recherche et en intégrité scientifique: une entreprise insensée?	This survey report, commissioned by the Ministry of Health and Social Services, briefly describes PAM (Plan d'action ministériel en éthique de la recherche et en intégrité scientifique). The survey also covers the first seven years of PAM's application, and includes both the evaluative and prospective components for each stakeholder identified. In the evaluative component, the Ministry evaluated whether the stakeholders were complying with PAM requirements and if they were aware of their responsibilities. In the prospective component, the Ministry wanted to know if PAM's measures were still appropriate considering the evolution of the sector, and if there were other ways in which to attain its objectives.	PAM proved to be quite audacious, as it radically changed the face of Quebec research supervision. Three elements, in particular, received the most attention: • The first element concerns the relative implementation of PAM's measures. Specifically, the Ministry must ensure that all the institutions in its network implement its proposed measures and also avoid creating a double ethical standard. The Ministry must also closely examine whether these measures have been implemented in practice, and not simply in theory. • The second element addresses the current problems associated with medical experimentation and the need to improve this standard. Notably, institutions continue to have difficulties implementing the related measures. • The third element addresses all recurring problems consistently polluting the field of research ethics, particularly with regard to the financing of CÉRs (les comités d'éthique de la recherche).	Audy, 2006

Appendix H Research Integrity and Research Misconduct Definitions from International Research Integrity Governance Systems and Post-Secondary Institutions

INTERNATIONAL RESEARCH INTEGRITY GOVERNANCE SYSTEMS

Australia (Australian Government, 2007)

Research Misconduct: Although not explicitly stated, the Australian Government qualifies research misconduct by those intentional, deliberate, or negligent acts that are in direct defiance of the Australian Code for the Responsible Conduct of Research. "Research misconduct includes fabrication, falsification, plagiarism or deception in proposing, carrying out or reporting the results of research, and failure to declare or manage a serious conflict of interest. It includes avoidable failure to follow research proposals as approved by a research ethics committee, particularly where this failure may result in unreasonable risk or harm to humans, animals or the environment. It also includes the willful concealment or facilitation of research misconduct by others. Research misconduct does not include honest differences in judgement in management of the research project, and may not include honest errors that are minor or unintentional."

China (Joint Committee for Promoting Research Integrity, 2009)

Research Integrity: "Research integrity mainly refers to the following behaviors of scientific workers in their scientific and technological activities: inspiring the scientific spirit with pursuing truth, seeking truth from facts, innovation-oriented, open-minded and collaboration as its core, in compliance with applicable laws and regulations, adherence to ethical principles of scientific study, and following the code of conduct accepted by scientific community."

Research Misconduct: Although there was no explicit definition, this Joint Committee acknowledges fabrication, falsification and plagiarism as key qualifiers of research misconduct.

Denmark (The Danish Committees on Scientific Dishonesty, 2008)

Scientific Dishonesty: "Falsification, fabrication, plagiarism and other serious violation of good scientific practice committed willfully or grossly negligent by planning, performing or reporting of research results."

Estonia (Estonian Academy of Science, 2002)

Research Integrity: Although not explicitly stated, the Estonian Academy of Science requires researchers "to adhere to the highest professional standards while mapping and practising research" and for scientists to preserve integrity "in every single phase of scientific research."

Research Misconduct: "Scientists will avoid any scientific misconduct or fraud, such as fabricating or falsifying data or records, piracy or plagiarism, sabotaging the work, records or protocols of other scientists, breach of confidence as a reviewer or supervisor."

Finland (National Advisory Board on Ethics, 2002)

Good Scientific Practice: In the absence of a formal definition for research integrity, the Finnish National Advisory Board on Ethics affirms that scientific research is ethically acceptable and credible when researchers conduct themselves in a manor synonymous with good scientific practice. To further elucidate this concept of good research conduct, a detailed list of acceptable research practices is provided, ranging from the endorsement of ethically sustainable data collection to good administrative practices.

"In contrast to these acceptable research practices, violations of good scientific practice are classified into two categories, which are misconduct in science and fraud in science. Misconduct and fraud in science may be perpetrated in the research process and in the presentation of results and conclusions. Misconduct and fraud in science not only violate the integrity of science, but those perpetrating them may also be guilty of an unlawful act. Honest differences in interpretations or judgments of data, meanwhile, are part of the scientific debate and do not violate good scientific practice."

Misconduct in Science: "Manifested as gross negligence and irresponsibility especially in the conduct of research. Other examples of misconduct in science include understatement of other researchers' contribution to a publication and negligence in referring to earlier findings; careless, and hence misleading, reporting of research findings and the methods used; negligence in recording and preserving results; publication of the same results several times as new; and misleading the research community about one's own research."

Fraud in Science: "Deceiving the research community and often decision-makers. It is to give false information or present false results to the research community or to disseminate them for instance in a publication, in a paper presented at a scientific conference, in a manuscript submitted for publication or in a grant application. Notably, Fraud in Science has a more egregious connotation, classifying fabrication, misrepresentation, plagiarism and misappropriation as examples of fraud."

Germany

Rules of Good Scientific Practice (Deutsche Forschungsgemeinschaft, 1998): In the absence of a formal definition for research integrity, the Deutsche Forschungsgemeinschaft affirms that scientific research is acceptable when researchers conduct themselves in a manor synonymous with good scientific practice. To further elucidate this concept of good research conduct, a detailed list of acceptable research practices is provided, ranging from honest documentation of results, to adherence to professional standards.

Scientific Dishonesty (Deutsche Forschungsgemeinschaft, 1998): "The conscious violation of elementary scientific rules. The broader term scientific misconduct is employed in contexts (e.g., of procedural rules) where the infringement of accepted good practice is discussed as a fact (irrespective of motive)."

Scientific Misconduct (Max Planck Society, 2000): "Scientific misconduct occurs when in a scientifically significant context, false statements are made knowingly or as a result of gross negligence, when the intellectual property of others is infringed, or if their research work is impaired in some other way."

Netherlands (ESF, 2008)

Research Integrity: Although not explicit, the National Board for Scientific Integrity has developed a memorandum on research integrity applicable to all scientific disciplines that are "rooted in the conviction that scientific research is based on mutual trust; exists by virtue of shared knowledge; and relies on statements based on objective observation and logical reasoning."

Research Misconduct: Although not explicitly stated, infringements of research integrity are classified into three primary categories (i.e., falsification, misleading and theft of intellectual property).

Norway (The National Committees for Research Ethics, 2006)

Scientific Misconduct: "Falsification, fabrication, plagiarism and other serious breaches of good scientific practice that have been committed willfully or through gross negligence when planning, carrying out or reporting on research."

Sweden (The Swedish Research Council, 2005)

Research Integrity: Although not explicit in defining research integrity, the Swedish Research Council acknowledges the need for honesty and integrity in research, citing a series of good research practices to support this aim. Specifically, "when analysing, interpreting and presenting their own results, or citing those of others, researchers [should] never distort or embellish those results in order to gain support for their hypotheses. Nor should researchers restrict themselves to citing research or data that corroborate the hypothesis they wish to pursue. Evidence to the contrary – if known – should also be presented." In fostering a culture of research integrity:

> Researchers should seek to adopt a critical stance towards their own expectations, and those of others, about what the data will demonstrate, and to their own and others' hopes of ground-breaking conclusions or rapid career progress. Nor should a researcher pass over in silence earlier investigators who have put forward the same or similar ideas to those now being tested. For the researcher, the requirement of honesty is very far-reaching. Research, by its very nature, involves a search for new knowledge, for an understanding that is as well-founded as possible – and researchers demonstrate their honesty precisely by respecting the results they arrive at.

Research Misconduct: "In a narrow sense, research misconduct refers to obvious violations involving the theft of other people's ideas and data, falsification and manipulation of data, and plagiarism of other people's texts. In a wider sense, it also includes other forms of reprehensible behaviour, such as dishonesty towards funding bodies, exaggeration of one's qualifications in applications, publication of the same study in multiple contexts, sexual harassment, defamation of colleagues, sabotage of colleagues' work and so on. Two terms can be used in this context: *research misconduct*, which has a narrower sense, presupposing an intention to deceive the reader, and *deviation from good research practice*, which can be found to have occurred without any need to speculate on whether the author had such an intention to deceive."

Switzerland

Scientific Integrity (Swiss Academies of Arts and Sciences, 2008): "The commitment of researchers to adhere to the basic rules of good scientific practice. Honesty and sincerity, self-discipline, self-criticism and fairness are indispensable for behaviour of integrity. They form the basis for all scientific activity and are prerequisites for the credibility and acceptance of science."

Scientific Misconduct (Swiss Academies of Arts and Sciences, 2008): Although lacking an explicit definition, the Swiss Academies of Arts and Sciences defines scientific misconduct as being "either intentional or due to negligence, society and in particular the scientific community is deceived and possibly harmed. In the framework of research projects this can happen in the planning and realization, in the analysis, in reflections concerning sources and ideas, in the procurement of research data, as well as in scientific expert appraisals or in the assessment of research projects and results. Violation of confidentiality or of intellectual property, fraudulent claims of authorship, dishonest impairment of a research activity, retaliatory measures against so- called whistle-blowers and incitement to dishonesty and its concealment also amount to scientific misconduct."

Scientific Misconduct (Swiss National Science Foundation, 2005): Although there was no explicit definition, the Swiss National Science Foundation classifies research misconduct by personal misconduct (i.e., defiance of good scientific practice), co-responsibility (i.e., third party intentional or negligent participation in an offence) and unfair practice (i.e., harassment of whistleblowers).

United Kingdom

Integrity (UK Research Integrity Office, 2009): "Organisations and researchers must comply with all legal and ethical requirements relevant to their field of study. They should declare any potential or actual conflicts of interest relating to research and where necessary take steps to resolve them."

Research Integrity (Research Councils UK, 2009): Although not explicitly stated, all individuals involved in research "are expected to observe the highest standards of research integrity and to embed good practice in all aspects of their work, including the training of new researchers. They must operate honestly and openly in respect of their own actions and in response to the actions of others involved in research."

Research Misconduct (UK Research Integrity Office, 2009): Although not explicitly stated, "UKRIO defines misconduct in research as including, but not limited to fabrication; falsification; misrepresentation of data;" plagiarism; and failure to exercise due care in research (e.g., avoiding unreasonable risk or harm, protecting private information).

United States

Research Integrity (Steneck, 2007): Although not explicitly stated, the DHHS Office of Research Integrity defines integrity in research as the commitment to a shared set of values (e.g., honesty, accuracy, efficiency, objectivity).

Academic Integrity (The Center for Academic Integrity, 1999): "A commitment, even in the face of adversity, to five fundamental values: honesty, trust, fairness, respect, and responsibility."

Research Misconduct (DHHS Office of Research Integrity, 2009): "Fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results."

POST-SECONDARY INSTITUTIONS CONSULTED BY THE PANEL

Centennial College (2005)

Research integrity: "Attitudes tied to researcher conduct, characterized by honesty, moral uprightness, and probity.

Research misconduct: Non-compliance of standards and terms of use in carrying out research activities. This expression also refers to the disregard of the rights of human or animal subjects in research."

Dalhousie University (2001)

Misconduct: "In relation to scholarly activity, misconduct is related to and involves the notion of a conscious or deliberate deception or action, and even such misconduct in relation to scholarly activity has degrees of seriousness. Conversely, misconduct in relation to scholarly activity shall not include any matter involving only an honest difference of opinion or an honest error of judgement."

Laval University (2009)

Research integrity: "Values influence the way we see the world and how we act. The moral values of absolute honesty and probity lay the foundation of integrity in research and creation.

Integrity in research and creation also implies strong management of data and funds for research."

Lethbridge College (2008)

Research and Scholarly Integrity: "Honesty and uprightness in dealings among colleagues, co-workers within the research and scholarly establishment as well as with students, assistants and staff on research projects, and in dealings with research and funding collaborators both within and outside the education community, respect for intellectual property, and due regard for the ethical points involved in the use of human and animal participants in research."

Research and Scholarly Misconduct: Although lacking an explicit definition, Lethbridge College alternatively illustrates scientific misconduct by providing a series of unacceptable research practices. Notably, this list does not provide a weight of severity for research offences, integrating actions that range from fabrication, falsification and plagiarism, to conflict of interest omissions. Further, "misconduct does not include honest errors, differences in opinion or different interpretations of scientific discoveries."

McGill University (2008)

Research Misconduct: Although not explicitly stated, research "misconduct includes, but is not limited to the definitions of the funding agencies for such misconduct. For example: fabrication, falsification, plagiarism, misappropriation of intellectual property rights of another, or any other conduct that constitutes a significant departure from the ethical and other standards that are commonly accepted within the relevant research community for proposing, performing, reporting or reviewing research or treating human and animal research subjects." Research misconduct does not include honest errors that are minor or unintentional.

McMaster University (1993)

Research Integrity: Rather than explicitly define research integrity, "the two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour."

Research Misconduct: Although not explicitly stated, McMaster University reduces misconduct in research to actions pertaining to proposing, conducting or reporting research. In these contexts, misconduct spans FFP practices (i.e., fabrication, falsification and plagiarism) to financial conflicts of interest.

Memorial University

Gross Research Misconduct: Rather than explicitly define research misconduct, Memorial University illustrates gross research misconduct by citing a wide range of offences. Notably, fabrication, falsification and plagiarism are defined first, with subsequent characterization of offences ranging from improper data collection to insufficient disclosure of financial conflicts of interest.

Niagara College of Applied Arts and Technology (2004)

Research Misconduct: Rather than explicitly define research misconduct, Niagara College of Applied Arts and Technology illustrates research misconduct by citing a wide range of offences. Notably, fabrication, falsification and plagiarism are defined first, with subsequent characterization of offences ranging from a violation of the Copyright Act to improper disclosure of material conflicts of interest.

Polytechnique Montréal (n.d.)

Research integrity: "Integrity in research is based on the scientific rigour and scholarly integrity in researchers' compliance to the standards, rules and regulations that govern project development, strong management of results and project funding, and that uphold the rights of all individuals involved in carrying out the project."

Research misconduct: "Misconduct means non-compliance by researchers of the rules, policies and directives, as well as specific regulations (federal, provincial, institutional, or other) that govern specific components of research activities.

Trickery and deception, whereby one deliberately misleads individuals participating in a research project as regards the objectives or the nature of a research project, are examples of misconduct."

Ontario College of Art and Design (2004)

Research Integrity: Although not explicit in its definition, "integrity in research and scholarship requires that researchers and scholars be honest in their pursuit of these activities, have respect for others and for intellectual property, demonstrate scholarly competence and stewardship of resources, and exercise due regard for ethical principles."

Research Misconduct: Adhering to the TCPS-IRS statement on research misconduct, "any action that is inconsistent with integrity" is deemed misconduct. "Scholarly misconduct includes actions or omissions that deviate from the fundamental principles of honesty (e.g., deception, falsification, plagiarism, retaliation, gross negligence, power abuse, abuse of confidentiality, non-compliance, misuse of funds, etc.). Misconduct does not include actions or omissions based on honest errors, conflicting data, interpretation differences, or professional differences (e.g., different perspectives for different disciplines; research protocols from an earlier time period)."

Queen's University

Academic Integrity (2006): "Academic integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility, all of which are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the 'freedom of inquiry and exchange of ideas' essential to the intellectual life of the University."

Research Misconduct (2009): Rather than explicitly define research misconduct, Queen's University illustrates research misconduct by citing a wide range of offences. Note that this list is not exhaustive. Notably, fabrication, falsification and plagiarism are defined first, with subsequent characterization of offences ranging from a failure to obtain authorship permissions to improper disclosure of financial conflicts of interest.

"Honest error, conflicting data or differences in interpretation of data, or differences in assessment of experimental design or practice do not constitute fraud or misconduct."

Rimouski CÉGEP (2002)

Research integrity: "We expect honesty and scholarly competence from researchers, in all aspects of their research activities. We expect them to show respect for others, ensure stewardship of resources, and act in accordance with established guidelines."

Cases of misconduct: "Actions contravening the Research Integrity Policy."

Saskatchewan Institute of Applied Science and Technology (SIAST) (2008)

Research Misconduct: Rather than explicitly define research misconduct, SIAST illustrates research misconduct by citing a wide range of offences. Note that this list is not exhaustive. Notably, fabrication, falsification and plagiarism are defined first, with subsequent characterization of offences ranging from a failure to obtain authorship permissions to an abuse of supervisor authority.

Sherbrooke CÉGEP (2009)

Research integrity: "Refers to researchers' attitude and conduct, which are characterized by honesty, moral uprightness, and probity.

Research misconduct: Refers mainly to the non-compliance of standards and terms of use in carrying out research activities. Also refers to the disregard of the rights of human or animal subjects in research."

University of British Columbia Board of Governors (2005)

Research Misconduct: Rather than explicitly define research misconduct, the University of British Columbia illustrates research misconduct by citing a wide range of offences. Notably, fabrication, falsification and plagiarism are defined first, with subsequent characterization of offences ranging from the unfair evaluation of scholarly works to insufficient use of scholarly and scientific rigour in obtaining and analyzing data.

University of Calgary (1995)

Research Misconduct: Rather than explicitly define research misconduct, the University of Calgary illustrates research misconduct by citing a wide range of offences. Notably, fabrication, falsification and plagiarism are defined first, with subsequent characterization of offences ranging from conflicts in scholarly interest to actions that deviate significantly from conventional good research practices.

"Misconduct shall not include any matter involving only an honest difference of opinion or an honest error of judgment."

University of Manitoba (1991)

Fraud in Research: Fraud in research is "a serious breach of the academic commitment of faculty members, and others concerned with the research endeavours of the University, to the search for truth and its free exposition." In this policy, academic fraud includes falsification, fabrication and plagiarism.

"Such acts may be committed with varying degrees of deliberateness. It must be recognized that the borderline between carelessness and negligence, on the one hand, and intentional dishonesty, on the other, may be very narrow or difficult to draw precisely."

Université de Moncton (2000)

L'inconduite en recherche: "Le manquement à se conformer aux règlements et aux normes d'intégrité en recherche."

University of Montréal

Scientific misconduct (2004): "Forms of scientific misconduct include:

- Fabrication, falsification and suppression of data results;
- Plagiarism and autoplagiarism (the publication of the same research results, without citing earlier works or parallel publications);
- Misappropriation of results, data, information or new concepts obtained during a peer review process;

- Use of criteria not related to the intellectual contributions or practices of researchers in publications and funding applications; and
- Non-disclosure of conflicts of interest during the funding applications process or when submitting manuscripts."

Research integrity (2002): "All forms of conduct that are expected by the various actors involved in research projects, and that respect the dignity of persons, protect animals and uphold the values intrinsic to science.

Breaches of research integrity (2002): All forms of intentional, negligent or reckless behaviours that threaten research integrity as previously defined."

University of Prince Edward Island (2006)

Fraud and Research Misconduct: Rather than explicitly define fraud and research misconduct, the University of Prince Edward Island has adopted an identical approach to that of the University of Saskatchewan, illustrating research misconduct by citing a wide range of offences. Notably, fabrication, falsification and plagiarism are defined first, with subsequent characterization of offences ranging from a "failure to comply with federal, provincial or University protection guidelines" in research, to improper disclosure of material conflicts of interest.

"The definition of fraud and misconduct in scholarly work does not include honest differences in research methodologies, interpretations or judgments of data, and theoretical frameworks."

Université du Quebec (n.d.)

Research misconduct: "Fraudulent behaviour, and in particular the fabrication or falsification of data, conflicts of interest, and plagiarism."

University of Saskatchewan (1993)

Fraud and Research Misconduct: Rather than explicitly define fraud and research misconduct, the University of Saskatchewan illustrates research misconduct by citing a wide range of offences. Notably, fabrication, falsification and plagiarism are defined first, with subsequent characterization of offences ranging from a "failure to comply with federal, provincial or University protection guidelines" in research, to improper disclosure of material conflicts of interest.

"The definition of fraud and misconduct in scholarly work does not include honest differences in research methodologies, interpretations or judgments of data, and theoretical frameworks. Depending on the circumstances of specific research projects, shoddy research may be considered misconduct."

University of Sherbrooke (2006)

Research integrity: "Integrity means absolute probity. Research integrity is based on the scientific rigour and intellectual honesty of researchers, and implies compliance with standards, rules and regulations applicable in carrying out a project, strong management of data funds, and a dedication to upholding the rights of all persons involved in carrying out scientific projects."

University of Toronto (2006)

Research Misconduct: "Intentional fabrication, falsification, plagiarism or other practices that deviate seriously from the commonly accepted ethics/integrity standards or practices of the relevant research community. However, in the latter respect, due latitude is given for honest errors, honest differences in methodology, interpretation or judgement, or divergent paradigms in science; what is at issue are genuine breaches of the integrity of the research process."

University of Waterloo (1994)

Research Misconduct: "A violation of the principles of intellectual honesty, including the misappropriation of writings, research and discoveries of others." The University of Waterloo also "defines misconduct in research as including, but not limited to fabrication, falsification, plagiarism and misappropriation of research funds."

University of Western Ontario (2008)

Academic Integrity: The University of Western Ontario's Teaching Support Centre has adopted the Center for Academic Integrity's definition for academic integrity, focusing its own integrity teaching strategies on "five fundamental values: honesty, trust, fairness, respect, and responsibility."

Research Misconduct: Alternatively defined as academic dishonesty, the University of Western Ontario illustrates research misconduct by citing a wide range of offences. Notably, fabrication, falsification and plagiarism are defined first, with subsequent characterization of offences ranging from "misappropriation of another's work to improper use of research funds."

"Honest mistakes and ambiguities of interpretation are unavoidable features of the pursuit of new knowledge and should not be considered misconduct in research."

Appendix I Glossary, Abbreviations, and Acronyms

DEFINITIONS OF TERMS SPECIFIC TO THIS REPORT

Actor: These include not only those who are actively engaged in the conduct of research, but also those responsible for the management and support of the research enterprise: individual researchers, academic institutions, the Tri-Council, other public-sector funders, and private-sector funders.

Institution: Organizations that conduct research and are eligible for Tri-Council funding.

Research: "An undertaking intended to extend knowledge through a disciplined inquiry or systematic investigation" (Interagency Advisory Panel on Research Ethics, 2008).

Tri-Council: Canada's three federal granting agencies: Natural Sciences and Engineering Research Council (NSERC), Canadian Institutes of Health Research (CIHR), and Social Sciences and Humanities Research Council (SSHRC).

ACRONYMS/ABBREVIATIONS

ACAHO	Association of Canadian Academic Healthcare Organizations
ARC	Australian National Research Council
AUCC	Association of Universities and Colleges of Canada
CAE	Canadian Academy of Engineering
CAHS	Canadian Academy of Health Sciences
CAUBO	Canadian Association of University Business Officers
CCAC	Canadian Council on Animal Care
CCPHRP	Canadian Council for the Protection of Human Research Participants
CCRI	Canadian Council for Research Integrity
CGS	Council of Graduate Schools (U.S.)
CÉR	Comités d'Éthique de la Recherche
CESHE	Committee for Ethics in Science and Higher Education (Croatia)

ICSU CFRS	International Council for Science Committee on Freedom and Responsibility in the Conduct of Science
CIHI	Canadian Institute for Health Information
CIHR	Canadian Institutes of Health Research
COPE	Committee on Publications Ethics (U.K.)
CRIF	Canadian Research Integrity Forum
DFG	Deutsche Forschungsgemeinschaft (Germany)
DHHS	Department of Health and Human Services (U.S.)
ERC	Ethics Resource Center (U.S.)
ESF	European Science Foundation
FFP	Fabrication, Falsification of data, and Plagiarism
GAP	Good Animal Practice
GOs	Governmental Organizations
GSF	Global Science Forum
HAL	Hickling Arthurs Low
IMC	Interagency Management Committee
IOM	Institute of Medicine (U.S.)
MOU	Tri-Council Memorandum of Understanding
NCEHR	National Council on Ethics in Human Research
NCISE	National Commission for the Investigation of Scientific Misconduct (Norway)
NGOs	Non-Governmental Organizations
NHMRC	National Health and Medical Research Council (Australia)
NIH	National Institutes of Health (U.S.)
NRC	National Research Council (U.S.)
NRIA	National Research Integrity Agency
NSERC	Natural Sciences and Engineering Research Council
NSF	National Science Foundation (U.S.)
OECD	Organisation for the Economic Co-operation and Development
OIG	Office of the Inspector General (U.S.)
ORI	Office of Research Integrity (U.S.)
PAM	Plan d'Action Ministériel en éthique de la recherche et en intégrité scientifique
PRE-SRE	Interagency Advisory Panel on Research Ethics and Interagency Secretariat on Research Ethics

QRP	Questionable Research Practice(s)
RCR	Responsible Conduct of Research
REB	Research Ethics Board
RIC	Research Integrity Committee
RSC	The Academies of Arts, Humanities and Sciences of Canada
SSHRC	Social Sciences and Humanities Research Council
SWOT	(S)trengths, (W)eaknesses, (O)pportunities and (T)hreats
TCPS-IRS	Tri-Council Policy Statement on Integrity in Research and Scholarship
UNESCO	United Nations Educational, Scientific and Cultural Organization
VP	Vice-President/Principal of Research

Assessments of the Council of Canadian Academies

The assessment reports listed below are accessible through the Council's website (www.scienceadvice.ca):

- Honesty, Accountability and Trust: Fostering Research Integrity in Canada (2010)
- Better Research for Better Business (2009)
- The Sustainable Management of Groundwater in Canada (2009)
- Innovation and Business Strategy: Why Canada Falls Short (2009)
- Vision for the Canadian Arctic Research Initiative: Assessing the Opportunities (2008)
- Energy from Gas Hydrates: Assessing the Opportunities and Challenges for Canada (2008)
- Small is Different: A Science Perspective on the Regulatory Challenges of the Nanoscale (2008)
- Influenza and the Role of Personal Protective Respiratory Equipment: An Assessment of the Evidence (2007)
- The State of Science and Technology in Canada (2006)

The assessments listed below are in the process of expert panel deliberation:

- Approaches to Animal Health Risk Assessment
- The Integrated Testing of Pesticides
- The State and Trends of Biodiversity Science in Canada
- Science Performance and Research Funding
- The Status of Women University Researchers in Canada