

UBC RESEARCH STRATEGY

VANCOUVER CAMPUS



a place of mind

THE UNIVERSITY OF BRITISH COLUMBIA

CONTENTS

■	Introduction	3
■	The importance of research at UBC	4
■	Defining excellence: selected examples	8
■	Key theme areas & partnerships	10
■	Actions to promote research excellence	12
■	Summary	24
■	Appendix: Research Clusters	29



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INTRODUCTION

“The University creates and advances knowledge and understanding, and improves the quality of life through the discovery, dissemination, and application of research within and across a wide range of disciplines.”

- *Place and Promise: The UBC Plan*

The compact statement of purpose and commitment in *Place and Promise: The UBC Plan* describes the core of research excellence as we understand it at UBC. Research Excellence is one of the three overarching commitments in *Place and Promise*, along with Student Learning and Community Engagement.

This document, the UBC Research Strategy, focuses on the commitment to Research Excellence and specifically, how the University should promote and nurture it. Excellence is difficult to define or measure, but the concept is generally understood at a major university such as UBC and by researchers within their respective fields. While it would be unrealistic to expect excellence in all UBC research, the goal of a major university must be to achieve it in as many different fields as possible.

A university must value research whose main purpose is to create knowledge and understanding, including the creation of artistic works. Such research changes the way we understand ourselves and our world, and enriches our lives. Equally important is goal-oriented research – such as improving health, reducing poverty, mitigating environment impacts, creating jobs and strengthening the economy – that makes communities more sustainable and society more robust. It is critical that we support and value both types of creative research, and that we resist viewing them as opposing or conflicting endeavours.

Improving our efforts to commercialize some of our research results should never come at the expense of research that does not have a clear commercial application. In the same way, it is wrong for us to view research that seeks to improve society as less valuable than research that has a major scholarly impact. While all types of research must be promoted, it is vital that universities vigorously promote basic or fundamental research (i.e., research that does not have a clear application or commercial outcome), as this type of research is typically least understood or valued by the broader community.

While many research strategies focus on areas of research to be promoted at a university, this strategy addresses the general issue of promoting research excellence, and it is rooted in the goals and actions set down in *Place and Promise*. It is also a “living document” that provides actions to be addressed in the coming years and modified as progress is made. As such, this document will only be published electronically, so it can be easily modified and updated.



John W. Hepburn, PhD, FRSC
Vice President Research & International

THE IMPORTANCE OF RESEARCH AT UBC

Terminology

UBC: In this document, UBC refers to the Vancouver campus and the affiliated health research institutes where much of our health research is conducted. While some elements of the strategy apply to all of UBC, the Okanagan campus has already defined its research strategy.¹ Research strategies are largely campus-specific because they are closely tied to academic programs.

RESEARCH: The types of scholarly activity occurring at a large university like UBC are typically referred to as research, scholarship or creative arts, although the definition of each label is not always clear and sometimes has certain values attached. In this strategy, the collective scholarly activities at UBC are referred to as “research” to simplify the terminology.

EXTERNAL COMMUNITIES: Our research can be carried out in partnership with, or be important to, a number of external groups, including companies, government organizations or departments, research labs, civil society organizations, community groups, and Aboriginal communities. In this document, “external communities” will refer to these groups or organizations, unless a specific group is being discussed.

¹ <http://web.ubc.ca/okanagan/provost-research/planning.html>

Excellent research is recognized in *Place and Promise* as one of the central aspects of UBC’s mission, and our international reputation is largely based on our research. While all universities have an important teaching mandate and should strive to create the best possible learning environment for their students, at major research-intensive universities like UBC the meaning of “learning environment” incorporates research to a far greater extent than at smaller universities, and graduate education is a much more significant part of our teaching mandate.

While all universities conduct research, at a well-funded university such as UBC that is ranked among the world’s leading universities, there is an obligation to conduct research that leads and defines the field, in as many different fields as possible. Not all research and not all researchers will meet this standard, and incremental advances will also contribute to our research and education missions, but this strategy focuses on promoting research that is at the leading edge.

One of the central roles of a large, research-intensive university is to carry out research that contributes to the educational mission of the university and also has an impact on society and the world. The modern university is a unique institution, evolved over many centuries to be one of the leading drivers of change in society. In no other institution is research conducted across such a diverse range of disciplines with researchers enjoying the freedom to choose their own topics of study and having the right (and even the obligation) to disseminate the results openly. This research is carried out by a mixture of faculty, staff, and students, and is integrated with the education of those students, creating a constant renewal of the research enterprise. For research that is intended to have a more immediate impact on our world, the university must facilitate maximizing that impact; impact is one of the more important measures of excellence for this type of research.

Defining Excellence

While everyone at a university should have some understanding of what excellence means, it is a great challenge to come up with a simple definition of excellence that is applicable across all domains, and to create unbiased ways of measuring it.

It is broadly accepted that one of the most important measures of excellence is peer review, or the opinion of other researchers about a given body of work. This is the basis for most academic publishing, for the awarding of most research funding, and for assessments such as the Research Assessment Exercise (RAE) that is conducted in the UK every seven years. Because peer review is complex, as the RAE shows, surrogate measures are often used, such as: funding levels, bibliometric analysis (citations, etc.), external awards and prizes to researchers, invitations to present at prestigious conferences, fellowship in prestigious societies, international collaborations, and service on important committees and boards (all of these are compared with the norms for a given area).

Rankings of universities will often use a mixture of peer review and these other measures in combination; the new version of the *Times Higher Education* rankings is an example. While these metrics are valid for much of the research effort, they neglect to measure possible research *impacts*, such as informing public policy decisions, improving health care, or creating wealth. These impacts should also be considered when defining what makes excellent research as there are many areas of research where the impact is more important than scholarly publications. Because we are a university, we also need to be concerned about the role research plays in education of students at all levels, as this training is one of the important outcomes of our research effort.

Defining Impact

It is important to clarify the meaning of impact, as recent discussions about commercializing the results of university research have led in much of the public discourse to a narrowing of the definition of research impact into one of a commercial outcome, or a combination of commercial and health outcomes. This is too narrow a view, as research at universities can have a profound impact on the way we understand ourselves and others in our society. Excellent research can change public policy, help us to understand and eliminate conflict, and help to improve society. Of course, much of the research at universities will lead to a stronger economy, more jobs and improved health outcomes.

Although it is risky to create a single summary of meaningful impact for research, perhaps the notion that *excellent research can create an improved quality of life or a better world* is one that embraces the full scope of our efforts. This definition of excellence also values research that doesn't have a commercial outcome or specific application. This emphasis on research impact, in addition to research excellence, is reflected in our vision statement in *Place and Promise* to "support outstanding research to serve the people of British Columbia, Canada, and the world."

Defining Areas of Excellence

Consistent with most university research strategies, this document will highlight certain research areas or themes that are important at UBC; however, it should be clear that *this is not an attempt to steer the research of the University community down defined paths*. The direction of research and the areas of emphasis are driven by a number of factors; among the most important are researcher interest, community need, and government and the priorities of funders.

University research strategies typically enumerate a number of areas of research deemed important to the university. Such lists are rarely informative as they generally specify areas of current strength within the university research portfolio, and to minimize hurt feelings they try to work in the efforts of as many researchers on campus as possible. Furthermore, the most important determinant of areas of research excellence comes from the recruitment strategies of academic units and the areas of research focus of affiliated institutes. Thus, faculties or institutes will develop their own academic plans, and this may create areas of concentration. Two current examples at UBC are the Faculty of Arts' focus on Asia and the Faculty of Medicine's focus on Brain Health.

What can be done is to use examples of research excellence that exist at UBC to help illustrate various aspects of what is meant by excellence. The strategy can also point to thematic areas that have been identified in *Place and Promise* as being important to UBC, as any strategy must support the overall vision defined in *Place and Promise*.

Diversity of Research

One of the greatest strengths of a large, research-intensive university is the range of research activities. This range of activity defines the cultural framework of the university community and creates an environment around the university that is critical to its social, cultural, and economic well-being. From creative and performing arts, where the production of a work of art or a performance is the scholarly creation, to engineering where the goal might be to improve an industrial process, all research at the university can contribute to improving lives, enriching culture, and furthering education.

However, a diverse research effort also creates a challenge when formulating a research strategy and providing appropriate support for that research. For those engaged in more solitary research, such as in pure mathematics or some humanities disciplines, significant research funding is far less vital than access to excellent library resources and time for detailed reflection. Research in the creative arts does require significant financial support, but this cannot be obtained through standard research grants. Most research does require significant external financial support, and support is increasingly needed for complex multidisciplinary projects, in addition to the standard types of projects driven by one or a few single-discipline investigators. For UBC to achieve its full potential, this diversity of needs must be recognized and strategies developed to support these various requirements.

Conducting Research Ethically

As a public institution, we have an obligation to conduct research to the highest ethical standards. While it is important not to create a system of ethical approvals that are so complex and cumbersome that they impede the research process, we also must attend to our obligations to the many communities that are involved in the research effort. There are clear statements of ethical requirements for all research conducted at UBC (e.g., the Tri-council Memorandum of Understanding). For research undertaken in partnership with communities, including community-based research, there is an obligation to work in true collaboration with these communities as equal partners in the research project. This is especially important for work with Aboriginal communities or vulnerable populations, which in the past have not always been treated as equal partners by some researchers.



Above: Vancouver's Downtown Eastside, one community that benefits from UBC research seeking to "create an improved quality of life or a better world."

DEFINING EXCELLENCE: SELECTED EXAMPLES

Typically, a research strategy will include a list of areas deemed to be of strategic importance to the institution. At a leading university like UBC, such a list would necessarily be quite long and would include many areas of research. As such, it would be of little use other than to generate controversy about areas that have been left out of the list.

While this strategy does not provide a compendium of specific areas that are of strategic interest to UBC, this does not mean that UBC does not have areas of excellence in research that deserve support, nor areas that are of special interest to UBC and our overall strategic vision, as defined in *Place and Promise*. Most important among these would be sustainability, where research is part of the “Campus as Living Laboratory” concept, but it also includes research focused on Asia, which is a key part of internationalization and an area of historic focus and strength at UBC.

To illustrate some of the areas of research excellence at UBC, and to give an indication of the diversity of research strength at UBC, a number of different examples of research excellence are given below. This list is illustrative, not comprehensive, and does not suggest a prioritization of research areas. Additional examples of research themes and clusters are provided in the Appendix (page 29).

Drug Research and Development

The Centre for Drug Research & Development (CDRD) builds on our excellent drug discovery research and provides a new model for drug development and commercialization. UBC played an important role in establishing CDRD and is a major partner and host to this Centre of Excellence for Commercialization and Research. CDRD is unique in Canada and there are very few similar organizations anywhere in the world. As a result, it has attracted national and global attention as an innovative answer to a common problem in translating laboratory results into new treatments.

Interactive Research in Sustainability

The Centre for Interactive Research in Sustainability, a green building currently under construction, is not just one of the world’s most sustainable large buildings—it is also a technical and social experiment. An example of strong partnership with external groups and companies, it will be a centrepiece for the UBC Sustainability Initiative.

HIV/AIDS

Important research into the treatment and prevention of HIV/AIDS is conducted by several research groups at UBC and at affiliated health research institutes. Notable among these is the Centre of Excellence for HIV/AIDS at St. Paul’s hospital. Much of this research has addressed vulnerable communities in BC, especially in the Downtown Eastside. In addition to setting new standards for treatment of HIV/AIDS, this research has had enormous public policy impact and international reach, and has established UBC as one of the world’s leading centres in this area.

Aboriginal Research

The Partnership of Peoples project at the Museum of Anthropology (MOA) showcases UBC research from several cultural viewpoints. The renovation undertaken for Partnership of Peoples was a significant demonstration of Federal and Provincial investment in UBC research through the Canada Foundation for Innovation and BC Knowledge Development Fund, and it remains one of the most important CFI awards nationally in the social sciences and humanities. MOA is significant to UBC research because it creates a new platform for collaborations between university researchers and Aboriginal communities, and sets new standards for the way museums understand and display cultural artifacts. It seeks to develop a Centre for Cultural Research throughout the Faculty of Arts.

Quantum Materials

A critical mass of internationally renowned investigators has established a quantum materials research cluster at UBC that is among the best in the world. Built on UBC's long-standing strength in condensed matter physics, this group has been built up through Canada Research Chair appointments and significant success in attracting external research funding. Their research excellence is reflected in the impact of their publications, major national and international awards, and international partnerships with some of the world's leading universities and research institutes. The importance of this research area was recognized in 2010 by the establishment of the Max Planck-UBC Centre for Quantum Matter at UBC, a new Max Planck International Centre.

Genomics

Research in genomics and proteomics gained significant momentum at UBC in the early 1990s with the awarding of Nobel Prize to our own Michael Smith (1993, Chemistry). It has since accelerated through a combination of strategic partnerships, recruitment and retention of world-leading investigators, and success in attracting funding for facilities, core equipment and research. This large and interdisciplinary cluster of investigators is active in human health (including cancer, neuroscience and infectious diseases), biotechnology, fisheries, viticulture, forestry and biodiversity. Genomics research at UBC was strengthened in 2010 with the awarding of a Canada Excellence Research Chair in Neurogenetics and Translational Neuroscience.

Clean Energy

UBC has become a natural hub for clean energy research through the formation of a number of research centres and external partnerships focused on the generation and storage of clean energy, including biofuels, gas hydrates and fuel cells. Convenient proximity to the National Research Council Institute for Fuel Cell Innovation, located on UBC's Vancouver campus, has provided significant shared resources and expertise. UBC's Clean Energy Research Centre has recently expanded its research program to include energy demand, supply, conservation and efficiency.

Biodiversity

More than fifty investigators in the Biodiversity Research Centre, who are housed under one roof in the new Beaty Biodiversity Centre, conduct interdisciplinary studies in evolution, systematic and phylogeny, population and community ecology, fisheries management, conservation biology, and theoretical modeling—from genes to ecosystems to interactions with human society. International collaborations have enabled UBC researchers to make valuable contributions in understanding and preserving biodiversity around the world. In particular, a cadre of internationally renowned fisheries experts have had provided significant input into domestic and international fisheries management policies.

Brain Research

Areas of excellence in this cluster include multiple sclerosis, mental health and addiction, stroke, neurotrauma, vision, and neurodegenerative disorders such as Alzheimer's, Parkinson's and Huntington diseases. The proposed Centre for Brain Health (scheduled to begin construction in 2011) will integrate existing facilities, centres and programs to create a centre of excellence focused on translational research and patient-centered care aimed at the causes, prevention, and treatment of brain dysfunction.

International Law

A growing cluster of expertise in international law has made valuable contributions to foreign and domestic policy in areas such as conflict resolution and human trafficking. Investigations in these areas are built on partnerships with institutions across Canada and internationally, particularly in the Pacific Rim, and have informed new legislation in Canada as well as providing the Federal government with valuable insights into the workings of foreign legal systems and infrastructure.

Asian Studies

UBC has great and long-standing strength in the general area of Asian Studies. While the Institute for Asian Research is a visible manifestation of this excellence, research about Asia and in collaboration with Asia is prominent in many places at UBC. Examples are as diverse as our History Department, where we have more specialists in Chinese history than any department in Canada, or our Faculty of Education, which is partnered with the Hanban Foundation in China because of our recognized expertise in teaching Mandarin as a second language (1500 students per year study Mandarin at UBC). All things considered, UBC has more expertise on Asia, and especially China, than any university in Canada, and more than all but a few universities in North America.

KEY THEME AREAS & PARTNERSHIPS

Many of the commitments in *Place and Promise* relate to UBC's engagement with external communities. UBC research is increasingly undertaken in partnership with external communities who help to define and conduct the research, apply the results, or pay for the work. Among the most significant of these are health research partnerships involving affiliated Health Authority research institutes, community health care agencies, advocacy groups, and hospital partners. With this in mind, some of the research areas, themes, and partnerships that are strategically important to UBC are given below.

Commitment to Community Engagement

One of the overarching commitments in *Place and Promise*, this will be partly addressed under the goal to become a world leader in knowledge exchange and mobilization, as much of our strategy for that will be to strengthen partnerships with external communities. Community engagement also includes research with Aboriginal communities and community-based research. In general terms, much of the impact from our research will depend on exchange of knowledge with external communities, as that knowledge informs our research effort, and helps our research to have its maximum impact. Although not all research directly relies on community engagement, the overall research enterprise will be better supported if the external community (and also the UBC community) is made aware of our research efforts and their importance.

Commitment to Student Learning

Much of the research work at UBC is conducted by graduate students, postdoctoral fellows and other research staff; accordingly, there is a very strong connection between research excellence and teaching and learning for those students. However, most of the students at UBC are undergraduates, many of whom are never directly connected to UBC's excellent research. There need to be more opportunities to allow undergraduates to participate in research at UBC, both through direct participation in advanced research and through being made aware of the excitement of current research going on. For more advanced research trainees, UBC should provide more than an excellent research environment—we must also provide training beyond their specific research projects.

Commitment to Aboriginal Engagement

A key commitment in *Place and Promise* is to Aboriginal engagement. This engagement has a research component, as given by one of the actions listed to support this commitment to "Strengthen and expand research grounded in significant community collaboration and consultation." MOA/Partnership of Peoples has already been mentioned as an example of this type of research, and there are other important examples of successful partnerships within the Faculties of Arts and Education. The Aboriginal Strategy addresses this important area, and the research strategy supports expansion of this effort.

Commitment to Intercultural Understanding

UBC's commitment to intercultural understanding in *Place and Promise* also has implications for a research strategy in that developing a better understanding is the goal of some of the research effort at UBC, and sharing that understanding through public debate and dialogue is an important means for our research to have impact on the broader society. Because of UBC's emphasis on Asia, we have a particular obligation to increase intercultural understanding between Asian and North American cultures.

Commitment to International Engagement

A separate International Strategy for UBC has been developed, so there is not a need to duplicate that effort in the Research Strategy. However, international partnerships are an important feature of research excellence, research collaborations are an important feature of any international strategy, and much of the research at UBC has a necessary international component. Support for international engagement will be an important component of the strategy.

Commitment to Sustainability

Sustainability is another strategic commitment in *Place and Promise*. Under the "Campus as a Living Laboratory" theme, the UBC Sustainability Initiative promotes initiatives that combine the University's campus operations and administration with its education, research and outreach mandates. Students and faculty develop and apply sustainability research and teaching in collaboration with University staff and industrial or community partners. Partnerships to advance sustainability will not be restricted to technology development but will include partnerships in social and health research and policy development, which are equally important features of sustainability.

Partnerships for Health Research

Health education and research at UBC is carried out in partnership with Provincial Health Authorities and the communities they serve. The importance of this collaboration is reflected in the fact that the majority of our health researchers work at Health Authority research institutes and hospitals, and they receive most of our external funding for health research. Discussions about unifying the administration of research at Health Authorities are underway, and UBC is working with the Health Authorities to help define this new vision.

ACTIONS TO PROMOTE RESEARCH EXCELLENCE

“The University creates and advances knowledge and understanding, and improves the quality of life through the discovery, dissemination, and application of research within and across a wide range of disciplines.”

- *Place and Promise: The UBC Plan*

One of the overarching commitments in *Place and Promise* is to Research Excellence. A number of actions support this commitment, and these form the basis for providing support for UBC’s research effort. The important goals that have been defined for research excellence are:

1. ***Increase the quality and impact of UBC’s research and scholarship; and***
2. ***Be a world leader in knowledge exchange and mobilization.***

The specific actions in *Place and Promise* supporting the above goals are still fairly high-level, and one of the objectives of this section is to suggest specific strategies that will make up these higher-level actions. In this section, the action from *Place and Promise* forms the heading for a more detailed set of strategies that will create the overall action.

Meeting these goals will require us to provide better support for UBC’s researchers, particularly for interdisciplinary research, research undertaken in partnership with communities and organizations external to UBC, and research with international partners. One of the most important determinants of excellent research is the opinion of peers, who are generally researchers and academics at universities around the world. Without diminishing the need to have our research recognized by other researchers, it is often true that for research to have its maximum *impact* we must connect and collaborate with non-university communities.

Some obvious examples are in commercialization, public policy and health research. Although public universities can facilitate the commercialization of research results, they are not commercial enterprises; partnerships are necessary with the private sector to commercialize university discoveries. While university research can and should have an impact on public policy, we must partner with external agencies to see our research translated into policy practice. Finally, health research is often performed in partnership with advocacy groups and affected populations; a potential breakthrough in treatment of disease that is discovered in a laboratory needs to be translated into clinical practice if it is to impact health care.

UBC therefore needs to take a leading role in developing its practices to embrace a broader concept of industry engagement, entrepreneurship and knowledge mobilization that meets the changing expectations of researchers, industry partners and government stakeholders. UBC can maximize its contribution to Canada’s innovation economy by creating clearer and more flexible paths for partners to engage with UBC research, and by building relationships with faculties, centres and institutes, industry, relevant networks, and other communities of practice and interest.

Summary of Actions to Promote Research Excellence

	Place & Promise Action	Research Strategy Action
PLACE AND PROMISE GOAL: INCREASE THE QUALITY AND IMPACT OF UBC'S RESEARCH AND SCHOLARSHIP	Focus on areas of excellence	<ol style="list-style-type: none"> 1. Provide focused assistance for researchers developing larger-scale initiatives, or for specific research funding opportunities as they arise, through an integrated grant facilitation office and better coordination of our network of facilitators. 2. Provide seed funding to enable organization of larger initiatives. 3. Develop international partnerships in defined areas of excellence. 4. Evaluate internal research support programs in order to design and deliver the most appropriate and effective programs. 5. Increase the number of external research prizes awarded to UBC faculty. 6. Improve understanding of the areas of research excellence at UBC. 7. Create a new partnership for health research.
	Increase UBC research and graduate support funding in both absolute and relative terms, including support from non-traditional sources	<ol style="list-style-type: none"> 8. Expand individual grant facilitation and internal review resources. 9. Increase scholarship support and funding packages for graduate students. 10. Increase international funding opportunities. 11. Increase cooperation with the UBC Development Office in working with foundations. 12. Investigate creation of a seed fund to support creative productions.
	Improve infrastructure to support leading edge research	<ol style="list-style-type: none"> 13. Increase common research equipment and improve support for that equipment. 14. Improve business practice and research information. 15. Investigate the creation of fellowships to support leading researchers and newer researchers. 16. Support the creation of new academic structures to advance research. 17. Expand opportunities for interdisciplinary dialogue.
	Expand recruitment of top-ranked graduate students and postdoctoral fellows	<ol style="list-style-type: none"> 18. Improve international recruitment of students. 19. Lobby for improved fellowships for graduate students and postdocs. 20. Work with MITACS to improve opportunities for graduate internships, including expansion of international internship, and to improve professional training. 21. Explore the creation of a new graduate residence similar to Green College and St. John's College. 22. Support <i>entrepreneurship@UBC</i> to provide training and resources for entrepreneurial students.
PLACE AND PROMISE GOAL: BE A WORLD LEADER IN KNOWLEDGE EXCHANGE AND MOBILIZATION	Increase emphasis on engaging external communities in research at UBC	<ol style="list-style-type: none"> 23. Facilitate development of partnerships to make "Campus as Living Lab" successful. 24. Advance research capacity at UBC through partnerships and collaborations with non-UBC entities. 25. Develop and expand research carried out in partnership with Aboriginal communities. 26. Develop a strategy to promote and support community-based research. 27. Develop an integrated industry engagement strategy for UBC. 28. Expand knowledge and appreciation of the importance of UBC research. 29. Engage alumni and the business community in entrepreneurial activities at UBC.
	Expand the multiplicity of knowledge exchange channels, such as global access licensing	<ol style="list-style-type: none"> 30. Create and/or identify and implement alternative Intellectual Property (IP) mechanisms for data, research tools, software and other research inventions. 31. Build relationships with Centres of Excellence for Commercialization and Research and with Business-Led Networks of Centres of Excellence to develop and advance UBC inventions. 32. Assume an international leadership role in the development of Global Access practices and apply these practices to UBC inventions.
	Develop a campus strategy for making UBC research accessible in digital (especially open-access) repositories	<ol style="list-style-type: none"> 33. Develop a central scholarly publications and data repository to ensure results of UBC research are freely accessible and meet the NIH and CIHR requirements regarding open access.

■ ACTION: Focus on areas of excellence

While this research strategy promotes research excellence as its primary objective, focusing on areas of excellence implies that not all research nor all research areas at UBC will achieve excellence. While excellence should be promoted wherever it occurs, there is a need to support and build areas of excellence at UBC, meaning groups or teams of researchers who work in a similar area or on a common problem. There is a synergy that develops between groups of leading researchers that creates better research and leads to greater possibilities for research funding.

Research training is also greatly improved if there is a critical mass of excellent researchers in a given area. This attracts better graduate students and postdoctoral fellows, and increases their chances for success—which in turn improves the research effort. Excellence in research is clearly rooted in getting the best researchers (faculty, students, and postdocs) to UBC, providing them with the support necessary to excel at research, and retaining the faculty at UBC, independent of field. However, we cannot hope to be world leaders in all areas of research, and decisions must be made about how to allocate resources in a way that creates global excellence in a few areas. In doing this, we also have to allow for emerging areas of research as well as individual research excellence, as research is inherently dynamic.

In addition to nurturing research excellence, we must do a better job of *recognizing and promoting* that excellence, especially to the external community. This increases support for university research and enhances our reputation.

ACTION #1: Provide focused assistance for researchers who are developing larger-scale initiatives, or for specific research funding opportunities as they arise, through an integrated grant facilitation office and better coordination of our network of facilitators

In recent years we have provided support for Networks of Centres of Excellence, Centres of Excellence for Commercialization of Research, and Canada Excellence Research Chair proposals, and other large group proposals, based on methods developed for institutional CFI proposals. While this has led to success in these applications, our efforts are limited by available resources for assisting researchers, which are currently distributed across our academic units. We need to do a better job of coordinating the activities of unit-level facilitators and employing emeriti faculty to allow more and better work to be done in supporting the development and improvement of these larger proposals.

ACTION #2: Provide seed funding to enable organization of larger initiatives

While it is preferable to not provide long-term internal funding for large research initiatives, there is frequently a need to provide an initial investment to help get them started. We need to consolidate and clarify the nature of these seed funding opportunities, link them to proposal development, and make researchers aware of available funding opportunities.

ACTION #3: Develop international partnerships in defined areas of excellence

It is important to use international connections to strengthen existing areas of excellence. This action is mentioned here as part of the Research Strategy but it is addressed in greater depth in the parallel International Strategy.

ACTION #4: Evaluate internal research support programs in order to design and deliver the most appropriate and effective programs

Several internal funds totalling a few million dollars are available to researchers, including the Hampton Fund, the Martha Piper Fund, the Peter Wall Institute, the International Initiatives fund, and various discretionary seed funds. A task force with broad disciplinary representation will be struck to recommend how these funds could be better coordinated and how they could better support and develop research excellence. This will also serve to improve awareness among researchers about internal funding opportunities.

ACTION #5: Increase the number of external research prizes awarded to UBC faculty

When our faculty members win prestigious external awards it not only provides recognition of their excellence (and frequently, a financial reward), it also greatly enhances the reputation of UBC researchers and the institution. A Presidential Advisory Committee on Major Awards has been established to increase both the quantity and quality of major award nominations from UBC, and to increase the number of external prizes won by our faculty.

ACTION #6: Improve understanding of the areas of research excellence at UBC

To better represent ourselves to potential partners and donors, and to better support research excellence independent of field, we need to develop better means of determining our areas of excellence that recognize inherent differences between research cultures. This involves consultation with the faculties and research units, both to understand how excellence is defined locally and to support the research priorities established by the units. This will also help us to be more effective in partnering with the Development Office to create opportunities for philanthropic and foundation support of major research efforts.

ACTION #7: Create a new partnership for health research

Most of UBC's health research, and nearly half of our external research funding, is due to researchers at affiliated research institutes operated by regional or provincial health authorities. These important partnerships for training and research need to be strengthened, and there have been discussions about creating an overall structure to better coordinate this important research. There is also a strong need to provide better support for these institutes, even in such basic areas as building operating costs. Supporting the effort led by the Vice-Provost, Health to create this new level of partnership will be key to our future success in health research.

■ ACTION: Increase UBC research and graduate support funding in both absolute and relative terms, including support from non-traditional sources

For most of the research activities at UBC, funding levels strongly influence the amount and quality of research that can be undertaken. In addition, funding levels are frequently tied to our ability to recruit and retain faculty, students, postdocs, and research staff. The participation of undergraduate students in many areas of research is also limited by the availability of funds to support their research.

Most of the research conducted at UBC depends on the involvement of graduate students. Although the roles of graduate students vary among research areas, the quality of the research that can be accomplished is frequently dependent on the quality of graduate students conducting the research, as well as the support provided to those students to enable their success. Even in areas where graduate students work independently of a research team, the overall level of research improves as the number and quality of students improves, and the quality of the research program is reflected by both the quality of graduate students attracted to that program and by their success. Thus, to improve research excellence at UBC it is critical to increase the amount of money available to support researchers and graduate students.

ACTION #8: *Expand individual grant facilitation and internal review resources*

One of the more successful initiatives to increase researcher success at UBC over the past decade has been the use of internal review, for health researchers through the Health Research Resource Office (HeRRO), and for institutional CFI applications through the CFI/BCKDF Resource Office. We have recently added two new permanent positions to the VP Research & International Office to expand the grant facilitation available to researchers outside the domain of health. However, more resources must be found to further increase the staff within our grant facilitation office. We also need to take advantage of other sources of support, such as the pool of emeriti faculty, to expand our efforts. This proposed action is linked to Action #1 in the previous section, as the same unit would provide support for both larger scale collaborative proposals and for individual researchers.

ACTION #9: *Increase scholarship support and funding packages for graduate students*

Recruiting the best graduate students and helping them to succeed will require increased funds for support packages and more significant scholarship funding for foreign graduate students. We will work in cooperation with the Faculty of Graduate Studies to lobby government to increase support for graduate students, and to increase support from the UBC budget for graduate funding packages. This action will largely be the responsibility of the Faculty of Graduate Studies, supported by the Research & International portfolio, and is linked to Action #19, which concerns fellowships for graduate students and postdoctoral fellows.

ACTION #10: *Increase international funding opportunities*

Now that the International Office is within the Research & International portfolio, more focus can be put on increasing funding for international research collaborations. This will be done through more effective grant facilitation and providing better and more timely information to researchers. We will also work closely with foreign partners, such as the Chinese Scholarship Council, to provide more funding for UBC researchers.

ACTION #11: *Increase cooperation with the UBC Development Office in working with foundations*

Much of the research at UBC is supported by charitable foundations. While this support is well established and understood by health researchers, we could do a better job of connecting researchers with foundations and other potential sources of research funding. This will be achieved in cooperation with the Development Office. We propose to incorporate this activity into the proposed new grant facilitation office described in Actions #1 and #8.

ACTION #12: *Investigate creation of a seed fund to support creative productions*

In the creative arts, money is needed to mount productions or to complete works. As funding sources are limited, it might be possible to create, perhaps through fundraising, a seed investment fund to support the creative arts. This would be somewhat different from normal seed funding, as there would be an expectation that in many cases proceeds from performances could replenish the fund.

■ ACTION: Improve infrastructure to support leading edge research

While the previous actions dealt with funding for research, there are other forms of support necessary for strong research. These include the systems and practices that are used to administer and regulate research, common facilities and infrastructure for research, space for collaborative and interdisciplinary research, and other forms of support for researchers.

ACTION #13: *Improve common research equipment and support for that equipment*

The CFI/BCKDF Resource Office has had an excellent record of helping groups of researchers obtain support for shared research equipment. This has led to a great improvement in the research equipment available to researchers, but it creates new challenges. To maximize the impact of this infrastructure, it should be made available to as many researchers as possible, and adequate support needs to be provided to maintain and operate this equipment. This can be accomplished by creating an inventory of equipment that is available for common use, and assisting research groups who are responsible for the equipment in finding external users who will use the equipment on a cost recovery basis. Increased support can also be obtained by lobbying governments and other external funders for increased support of indirect costs, which can then be used to support maintenance and operation.

ACTION #14: Improve business practice and research information

While necessary, the administrative systems in place for research can sometimes impede the research process by becoming cumbersome or bureaucratic. Examples can include ethical reviews for research with human subjects or animals, contracts for research partnerships, or agreements for collaborative research. We are finishing a complete overhaul of our core support system, the RISE system, and we are helping to develop a harmonized system for ethics approvals for clinical research in BC. There is still work to be done to ensure that RISE meets the needs of our researchers and that the processes of ethics approvals and contracts are streamlined. We also need to create a more efficient system for negotiating research and service contracts through the use of standard agreements, and clarification of liability and indemnification issues.

ACTION #15: Investigate the creation of fellowships to support leading researchers and newer researchers

One of the most important issues in many areas of research is the need for time to conduct research. This is especially true for researchers early in their careers, when they are trying to establish a reputation. For all researchers, a competitive fellowship program should be investigated to add to the supply of internal research fellowships.

ACTION #16: Support the creation of new academic structures to advance research

Two recent proposals for the creation of new structures and programs that could support research excellence include an Institute for Humanities and a School of Public Policy. While UBC may choose not to proceed with either proposal, these and other similar structures should be investigated. Humanities scholars often work in isolation, which can disadvantage them compared with other disciplines. An Institute of the Humanities, which would include an interdisciplinary graduate program, could strengthen humanities research and graduate studies. A School of Public Policy could provide an increased understanding of how university research, particularly scientific research, could be used to inform and change public policy.

ACTION #17: Expand opportunities for interdisciplinary dialogue

There are not enough locations and opportunities on campus for researchers to meet informally to develop an understanding of research outside of their own disciplines. The old Faculty Club is often used as an example of a place where such discussions could be held. Currently, there are some places and opportunities provided by the Peter Wall Institute and the graduate colleges. Expanding the role of these places, promoting better synergy between them, and establishing new spaces for dialogue would foster a better environment for interdisciplinary research on campus.

■ ACTION: Expand recruitment of top-ranked graduate students and postdoctoral fellows

Many of UBC's most promising researchers are in fact trainees: graduate students and postdoctoral fellows. An emphasis on research trainees does not detract from the important role of professional research staff and faculty, but it is generally agreed that a university has a special obligation to support researchers-in-training.

ACTION #18: Improve international recruitment of students

As an internationally important university, we should attract the very best students from around the world into our graduate programs. This not only improves the overall quality of those programs and allows for expansion of our graduate enrollment, it also creates future international linkages through our alumni when they leave UBC. This network has helped other leading universities to internationalize their research effort.

ACTION #19: Lobby for improved fellowships for graduate students and postdoctoral fellows

This action is linked to Action #9 in the previous section and will be an important component for achieving the goal of recruiting internationally, where there are currently fewer scholarship opportunities.

ACTION #20: Work with MITACS to improve opportunities for graduate internships, including expansion of international internship, and to improve professional training

We can strengthen graduate education by offering research-based internships and other discipline-specific opportunities for graduate students to gain off-campus or international experience in industry, government, or civil society. It is also important to offer experiences that develop personal leadership and other "soft skills" for career advancement. As a Network of Centres of Excellence based on UBC's Vancouver campus, MITACS is well positioned to partner with UBC in this respect.

ACTION #21: Explore the creation of a new graduate residence similar to Green College and St. John's College

UBC's graduate residences provide badly needed housing – especially important for international students – and a place for informal discussions among students from different disciplines, which improves their learning environment. We can only accommodate a small fraction of our graduate students in Green College and St. John's College, and there is a strong demand for more residences like them. One exciting possibility for a new graduate residence is a proposed "sustainability house" on south campus.

ACTION #22: Support entrepreneurship@UBC to provide training and resources for entrepreneurial students

The *entrepreneurship@UBC* program provides access to mentorship, training, alumni networks and funding that allow students and recent graduates to develop and pursue business opportunities with significantly greater chances of success. In the long term, this program will further UBC's position as an entrepreneurial environment attractive to high-quality students.

■ ACTION: Increase emphasis on engaging external communities in UBC research

ACTION #23: Facilitate the development of partnerships to make “Campus as Living Lab” successful

“Campus as a Living Lab” promotes initiatives that combine the University’s campus operations and administration with its education, research and outreach mandates. Students and faculty develop and apply sustainability research and teaching in collaboration with University staff and industrial or community partners. These partnerships are not restricted to ones with external companies for technology development, although those are an important component to “Campus as Living Lab.” On-campus partnerships and work with external organizations and governments are also an important feature of our sustainability strategy. It is important to change the way UBC behaves as well as implementing successful strategies in the broader community.

ACTION #24: Advance research capacity at UBC through partnerships and collaborations with non-UBC entities

A number of non-UBC research organizations have greatly improved our research capacity and played an important role for our researchers, including the Pacific Institute for Mathematical Sciences, MITACS, and the Banff International Research Station. UBC’s Clean Energy Research Centre has a longstanding, mutually beneficial partnership with the NRC Institute for Fuel Cell Innovation, and UBC also has strong and historic ties with the TRIUMF national laboratory; both of these institutes are located on UBC’s Vancouver campus. There are many opportunities for similar partnerships with other institutions and organizations that should be developed.

ACTION #25: Develop and expand research carried out in partnership with Aboriginal communities

This is a very important priority for UBC and forms a part of the Aboriginal Strategy. The Research & International portfolio needs to work with the Senior Advisor to the President on Aboriginal Affairs and the Standing Committee for the Aboriginal Strategic Plan to support the research goals of the Aboriginal Strategy.

ACTION #26: Develop a strategy to promote and support community-based research

Conducting community-based research presents specific issues and challenges, particularly when working with vulnerable or marginalized populations. This type of community engagement builds on UBC’s strength in research with vulnerable populations (e.g., in HIV/AIDS, mental health and addictions, etc.) and our focus on community service learning. The VP Research & International will work with the Learning Exchange and the VP External, Legal, and Community to develop a plan for supporting and promoting community-based research.

ACTION #27: Develop an integrated industry engagement strategy for UBC

There are several different levels of industrial engagement, from partnership for commercialization or research, to provision of technical services such as instrumental analysis or animal care. We need to develop a mutually beneficial strategy to facilitate this engagement at all levels, and to improve our research efforts through this engagement. A key part of this will be the creation of a high-level external advisory committee that will help to define the engagement strategy.

Opportunities for industry to access the innovation, expertise and facilities at UBC to solve real-world problems include: hiring co-op students, sponsoring projects in undergraduate research laboratories, and entering into faculty consulting and collaborative research agreements. These activities are largely managed in a distributed fashion across UBC's campuses, and the lack of a single point of contact for industry can be daunting and lead to lost opportunities for mutually beneficial engagement. The University should create a portal for industry that directs and facilitates enquires and builds linkages and relationships. Industry networking and problem-solving events should be developed with a view to identifying and creating research consortia involving industry partners who support and help direct relevant research programs in partnership with UBC researchers.

ACTION #28: Expand knowledge and appreciation of the importance of UBC research

Continued public and political support for all aspects of our research effort relies on a better understanding and appreciation of our research. In cooperation with the VP External, Legal, and Community, we will promote research across the full range of activity, not simply highlighting research with clear applications. This action is linked to Action #6, which concerns improving our own understanding of the areas of research excellence at UBC.

ACTION #29: Engage alumni and the business community in entrepreneurial activities at UBC

Increasing engagement with alumni and the business community through *entrepreneurship@UBC* mentorship, teaching and contributing to the *entrepreneurship@UBC* Fund will assist in capitalizing on UBC research activities.

■ ACTION: Expand the multiplicity of knowledge exchange channels, such as global access licensing

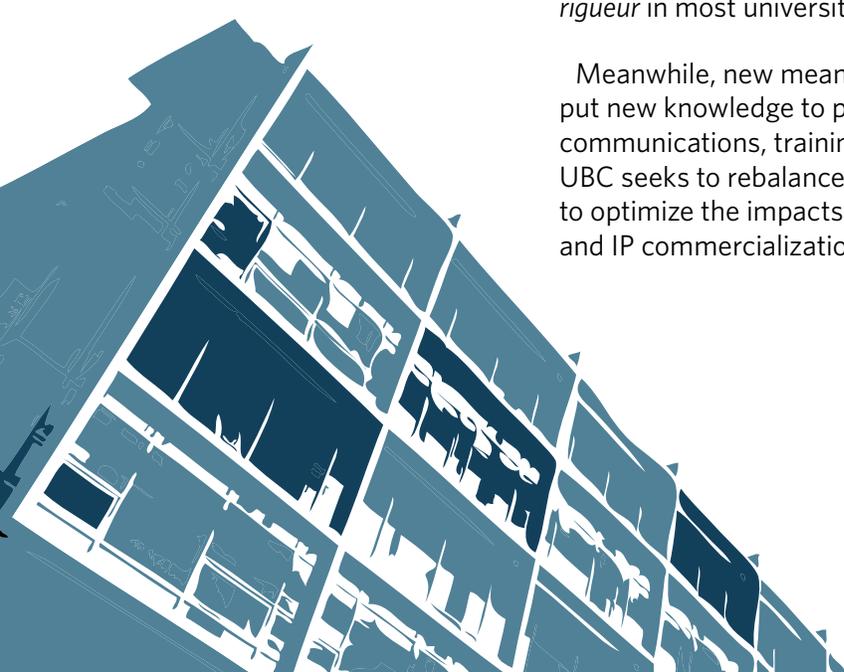
The four types of innovation (occurring in products, processes, marketing and organizations) present as either *incremental* or *disruptive* innovation. Incremental innovation provides a source of continuous improvement in which developments are new to a company but not necessarily to the world. This enhances the competitiveness of companies in mature markets; for example, using computation fluid dynamics analysis to model the operation of pulp and paper recovery boilers. Because the Canadian economy largely consists of mature markets, incremental innovation plays a predominant role in promoting competitiveness. UBC is well positioned to serve society by maintaining a globally competitive knowledge base, providing a source of innovation to a broad range of existing firms. UBC is also a source of disruptive innovation, or game-changing ideas and technologies that seed the companies and sectors of the future.

In recent years, the “closed” model of innovation has eroded through a multitude of factors, from technical innovations and the increased mobility of highly qualified personnel, to a growing sense of social responsibility. Instead of relying on an innovation system in which research and development is tightly controlled by individual companies, the global economy is incorporating the principles of open innovation in which ideas, intellectual property and personnel flow more freely and rapidly. Open-source models are now common within networks, communities and more broadly. Whether the motivation is for social good and/or to advance technologies, traditional proprietary approaches to research and knowledge are no longer always the most appropriate way to drive innovation.

In academia there has been a longstanding fascination with the use of intellectual property (IP) to pursue financial, economic and societal gain. IP protection and commercial exploitation have often conflicted with traditional academic values of free and open dissemination. While many university technology transfer offices have achieved commendable results, closer examination of their portfolios shows that only 1 in 1,000 technologies could be categorized as a blockbuster success, and only 2% of inventions account for 99% of revenue. Despite this reality, strict IP practices have become *de rigueur* in most university research enterprises.

Meanwhile, new means of *knowledge translation* are gaining favour. These put new knowledge to practical use by informing policy and practice through communications, training, tools, standards, and professional certification. UBC seeks to rebalance its role and expand its toolbox of approaches in order to optimize the impacts derived from knowledge translation, open innovation, and IP commercialization.

Left: The Michael Smith Laboratories, a hub of genomics and proteomics research at UBC, named after the late Dr. Michael Smith (1932-2000), co-recipient of the 1993 Nobel Prize in Chemistry.



A renewed focus is required to increase access to, and dissemination of, research tools, data, and artifacts developed at UBC and our affiliated partners. We must explore and engage the use of new open-innovation IP channels such as data/material repositories, IP aggregation channels, open-source licensing, and patent pools. Support must be given to knowledge translation opportunities at UBC through the development of appropriate strategies and work-plans, and the identification of partners, resources, and seed and sustainable long-term funding.

ACTION #30: Create and/or identify and implement alternative Intellectual Property (IP) mechanisms for data, research tools, software and other research inventions

There is a great deal of discussion locally and across the country about best practices for management of university-generated IP. UBC needs to be fully engaged in this discussion and must work to develop innovative ways of treating IP to maximize commercialization success and knowledge exchange while protecting the rights of UBC researchers.

ACTION #31: Build relationships with Centres of Excellence for Commercialization and Research (CECR) and with Business-Led Networks of Centres of Excellence to develop and advance UBC inventions

These relatively new, Federally-funded centres and networks provide new channels for knowledge exchange and research translation. UBC researchers have successfully engaged these programs and several CECRs are hosted at UBC, including the Centre for Drug Research and Development mentioned earlier.

ACTION #32: Assume an international leadership role in the development of Global Access practices and apply these practices to UBC inventions

UBC has taken a leadership role in adopting Global Access licensing practices that make technologies available at cost to poor countries. We now need to develop effective means of identifying and helping to develop these technologies in partnership with the global south.

■ ACTION: Develop a campus strategy for making UBC research accessible in digital repositories, especially open-access repositories

ACTION #33: Develop a central scholarly publications and data repository to ensure results of UBC research are freely accessible and meet the NIH and CIHR requirements regarding open access

This is a partnership with the UBC Library that helps to promote more openness in our research. A more detailed plan of action will be developed in cooperation with the University Librarian.

SUMMARY

At the core of our claim to be “one of the world’s leading universities” is conducting excellent research that helps us to better understand ourselves and our world. The support and fostering of research excellence is central to this Research Strategy.

This strategy has focused on concrete actions to promote research excellence in support of the overall UBC strategy, *Place and Promise*. While even a great university like UBC cannot hope to achieve excellence in all of its research efforts, it should be expected in a large number of areas. And while achieving excellence is always based on the recruitment and support of excellent researchers, there will be areas where the achievement of excellence relies on the work of teams of researchers working within or across disciplines.

This strategy does not enumerate the specific areas in which we shall focus attention and support, but rather discusses actions that will help individual researchers and teams of researchers achieve excellence. This strategy also focuses on actions that will be taken by the Research and International portfolio, either on its own or in support of other UBC units. As one of the central commitments in *Place and Promise*, research excellence will also be promoted throughout the university and supported by the creation of an exceptional learning environment, which is central to all we do at UBC.

In the previous sections, the specific actions to promote research excellence were listed under the headings given in *Place and Promise*. When the actions are considered as a whole, they can be reorganized somewhat differently into seven areas:

1. ***Improving success in applications for external research funding***
2. ***Recognizing excellence in research***
3. ***Developing stronger research partnerships***
4. ***Providing better support for researchers***
5. ***Improving recruitment and training***
6. ***Creating new structures for research***
7. ***Improving knowledge mobilization***

Here, we restate the proposed actions into these seven themes and summarize them on page 28. Where appropriate, several individual actions are combined into a single overarching action.

Improving success in applications for external research funding

This overall action is covered in several of the detailed actions given in the previous section. We propose to create a central office to facilitate and support researchers who are seeking external funding. This office, which will be based on our previously successful efforts with the CFI/BCKDF Resource Office and the Health Research Resource Office (HeRRO). After support for HeRRO from the Michael Smith Foundation for Health Research was cancelled in 2009, we were able to preserve part of the office through a UBC budget allocation. In the coming years, we need to expand our effort to support individual researchers and research teams in all areas of research.

This overarching goal may be summarized thusly:

Expand and consolidate activities to support researchers applying for external research funding by creating the Support Programs to Advance Research Capacity (SPARC) office.

The VP Research & International Office will assist individual researchers and groups of researchers, and will provide assistance for all types of external funding sources. This overall action will achieve the following individual actions previously listed:

- Provide focused assistance for researchers who are developing larger-scale initiatives, or for specific research funding opportunities as they arise, through an integrated grant facilitation office and better coordination of our network of facilitators
- Individual grant facilitation and internal review
- Increase international funding opportunities
- Cooperate with the Development Office on working with foundations

Recognizing excellence in research

Excellence in research is based on the efforts of faculty members at UBC, and it is important that every effort be made to ensure that our best faculty get the recognition they deserve for their research accomplishments. We also need to develop a better understanding of the research areas where UBC is in a leading position. Finally, we need to do a better job of communicating this success to the broader communities beyond UBC. Rather than a single overarching action, a combination of efforts will help identify, promote and reward research excellence:

- Increase the number of external research prizes awarded to UBC faculty
- Improve understanding of the areas of research excellence at UBC
- Expand knowledge and appreciation of the importance of UBC research

Developing stronger research partnerships

Research excellence increasingly relies on partnerships with external communities and organizations. Although UBC has an excellent track record in this regard, there are several exciting new opportunities for partnerships that need to be developed in the coming years to help advance research excellence at UBC. Actions in this regard include:

- Develop international partnerships for defined areas of excellence
- Create a new partnership for health research
- Facilitate the development of partnerships necessary to make “Campus as Living Lab” successful
- Expand university research capacity by fostering and managing partnerships and collaborations with non-UBC entities
- Develop and expand research carried out in partnership with Aboriginal communities

- Develop a strategy to promote and support community-based research
- Develop an integrated industry engagement strategy for UBC
- Engage alumni and the business community in entrepreneurial activities at UBC
- Provide better support for researchers

Providing better support for researchers

In addition to helping researchers to secure external funding, a number of actions can be taken to expand research capacity at UBC:

- Provide seed funding resources to enable organization of larger initiatives
- Evaluate internal research support programs in order to design and deliver the most appropriate and effective programs
- Investigate creation of a seed fund to support creative productions
- Increase scholarship support and funding packages for graduate students
- Improve common research equipment and support for that equipment
- Improved business practice and research information
- Create fellowships to support leading researchers and newer researchers

The first two actions relate to internal funds that support research at UBC, while the third action could create a new source of funds to support creative activities. Compared with the large amounts of external funding that support research, internal funding is insignificant but it is important in some areas and can play an important catalytic role. Support for students and faculty and the provisioning of better information and infrastructure are also important elements of research excellence.

Improving recruiting and training

The linkage between research and training is a key feature of university research. Similarly, research excellence is closely tied to our ability to recruit the best people from around the world. Once we recruit these students and postdocs, we need to provide excellent programs for them and give them strong financial support. While the recommendations here are more the responsibility of other organizations, such as MITACS and the Faculty of Graduate Studies, the Research and International portfolio must provide strong support for these efforts.

- Improve international recruitment of students
- Lobby for creation of improved fellowships for graduate students and postdocs
- Work with MITACS to improve opportunities for graduate internships, including expansion of international internships, and to improve professional training
- Support *entrepreneurship@UBC* to provide training and resources for entrepreneurial students

Creating new structures for research

In addition to creating systems to support researchers, UBC should investigate the creation of physical structures and programs to encourage researcher interactions and interdisciplinary dialogue and action. Progress in these efforts will rely on action taken by other units, so the role of the Research and International portfolio is a supporting and encouraging one.

- Support the creation of new academic structures to support research
- Expand opportunities for interdisciplinary dialogue
- Explore the creation of a new graduate residence similar to Green College and St. John's College

Improving Knowledge Mobilization

Along with research partnerships, knowledge mobilization is one of the key challenges for universities in the coming few years. While knowledge mobilization includes traditional technology transfer activities, it is a much broader concept than commercialization of research results. The actions below, along with the previously listed research partnership actions, will help advance our knowledge mobilization activities.

- Create and/or identify and implement alternative Intellectual Property (IP) mechanisms for data, research tools, software and other research inventions
- Build relationships with Centres of Excellence for Commercialization and Research and Business-Led Networks of Centres of Excellence to develop and advance UBC inventions
- Assume an international leadership role in the development of Global Access practices and apply these practices to UBC inventions
- Work to develop a central scholarly publications and data repository to ensure results of UBC research are freely accessible and meet the NIH and CIHR requirements regarding open access

Summary of Research Strategy Actions by Theme

Theme	Research Strategy Action
Improving success in applications for external research funding	<ul style="list-style-type: none"> 1. Provide focused assistance for researchers developing larger-scale initiatives, or for specific research funding opportunities as they arise, through an integrated grant facilitation office and better coordination of our network of facilitators. 8. Expand individual grant facilitation and internal review resources. 10. Increase international funding opportunities. 11. Increase cooperation with the UBC Development Office in working with foundations.
Recognizing excellence in research	<ul style="list-style-type: none"> 5. Increase the number of external research prizes awarded to UBC faculty. 6. Improve understanding of the areas of research excellence at UBC. 28. Expand knowledge and appreciation of the importance of UBC research.
Developing stronger research partnerships	<ul style="list-style-type: none"> 3. Develop international partnerships in defined areas of excellence. 7. Create a new partnership for health research. 23. Facilitate the development of partnerships to make Campus as Living Lab successful. 24. Advance research capacity at UBC through partnerships and collaborations with non-UBC entities. 25. Develop and expand research carried out in partnership with Aboriginal communities. 26. Develop a strategy to promote and support community-based research. 27. Develop an integrated industry engagement strategy for UBC. 29. Engage alumni and the business community in entrepreneurial activities at UBC.
Providing better support for researchers	<ul style="list-style-type: none"> 2. Provide seed funding to enable organization of larger initiatives. 4. Evaluate internal research support programs in order to design and deliver the most appropriate and effective programs. 9. Increase scholarship support and funding packages for graduate students. 12. Investigate creation of a seed fund to support creative productions. 13. Improve common research equipment and support for that equipment. 14. Improve business practice and research information. 15. Create fellowships to support leading researchers and newer researchers.
Improving recruitment and training	<ul style="list-style-type: none"> 18. Improve international recruitment of students. 19. Lobby for improved fellowships for graduate students and postdoctoral fellows. 20. Work with MITACS to improve opportunities for graduate internships, including expansion of international internship, and to improve professional training. 22. Support <i>entrepreneurship@UBC</i> to provide training and resources for entrepreneurial students.
Creating new structures for research	<ul style="list-style-type: none"> 16. Support the creation of new academic structures to advance research. 17. Expand opportunities for interdisciplinary dialogue. 21. Explore the creation of a new graduate residence similar to Green College and St. John's College.
Improving knowledge mobilization	<ul style="list-style-type: none"> 30. Create and/or identify and implement alternative Intellectual Property (IP) mechanisms for data, research tools, software and other research inventions. 31. Build relationships with Centres of Excellence for Commercialization and Research and with Business-Led Networks of Centres of Excellence to develop and advance UBC inventions. 32. Assume an international leadership role in the development of Global Access practices and apply these practices to UBC inventions. 33. Develop a central scholarly publications and data repository to ensure results of UBC research are freely accessible and meet the NIH and CIHR requirements regarding open access.

APPENDIX: RESEARCH CLUSTERS

To tackle the broad goals described in this Research Strategy, the University has identified three over-arching themes representing areas of strength and opportunity for future innovation at the Vancouver campus. These three over-arching themes, and the research clusters within each theme, are:

Life and Health Sciences

1. Biotechnology and Genomics
2. Human Health and Genomics
3. Neuroscience and Cognitive Systems
4. Population Health and Human Development

Society, Culture and Globalization

5. Culture and Its Representation
6. Society in Global Context

Physical Sciences, Environment, and Entrepreneurship

7. Microelectronics, Information Technology and E-commerce
8. Quantum Structures and Information
9. Nanoscience and Nanotechnology
10. Origins and Mathematical Structure
11. Sustainability/Environment

Research goals, major initiatives, and progress milestones in each of the eleven clusters are summarized below.

Biotechnology and Genomics

This cluster is linked to growth in products derived from biotechnology, including new drugs; new crop varieties; improved processing enzymes, cultures, human tissues and organs; new polymers; and improved methods for treating environmental contamination.

A significant locus for biotechnology and “-omics” research is the Michael Smith Laboratories (MSL). Located in the heart of the UBC campus, these laboratories are housed in a state-of-the-art CFI-funded facility, a realization of the vision of its founding Director and Nobel Laureate, Dr. Michael Smith. MSL houses portions of the CFI-funded Laboratory for Molecular Biophysics and also incorporates the Canadian Genetic Disease Network and UBC Bioinformatics Centre. The second and third floors of the new building are dedicated to research and provide a home to a number of CRC’s and other researchers representing five faculties who explore organisms ranging from worms and mice to trees.

In addressing challenges in biotechnology and genomics, there is significant benefit in stepping beyond the domain of the genome, proteome, and related “omics” to adopt a systems biology approach. An evolving systems biology initiative to capitalize on existing UBC expertise and infrastructure is the Centre for High-throughput Biology (CHiBi). This group has expertise across the physical/life sciences interface and shares a common interest in the use of high-throughput approaches to interrogate or manipulate biological systems. Capitalizing on the availability of high-throughput genomics,

proteomics, and bioinformatics expertise at UBC, this group is well positioned to explore biology using a systems approach. CHiBi researchers and associates are also involved in technology development in areas as diverse as computational biology, cell biology, chemical biology, nucleotide and peptide sequencing, microfluidics, and imaging.

UBC is applying meta-genomic approaches with metabolic and biosynthetic engineering to develop new technologies for producing energy, fuels, chemicals, and materials from renewable sources. This interdisciplinary research effort is motivated by a clear and compelling opportunity to develop the biomass remaining from tree and crop harvesting – one of Canada’s most abundant natural resources – as a feedstock for a diverse and growing bio-refining industry. ■

Human Health and Genomics

This cluster encompasses core research in infection and immunity, cancer, cardiovascular and respiratory, wound healing, pathogenomics, pharmacogenomics, genomic imprinting, anti-microbial drug development, transplant research, stem cell genomics, asthma, gene-based medicine, genetics and behaviour, and blood proteins.

Strong research groups are housed in the new Life Sciences Centre on the UBC Vancouver campus and at hospital-based research institutes (CFRI, VCHRI, Providence, BCCA, BC CDC) in Greater Vancouver. UBC’s strength and leadership in the field of genomics is underscored by numerous faculty honours, including the awarding of the 1993 Nobel Prize in Chemistry to the late Dr. Michael Smith for his work in basic molecular genetics.

‘Gene-to-society’ research efforts engage both multidisciplinary and systems approaches and focus on human biology in health and disease across the lifespan. There is a strong focus on providing children with the best possible start in life, including determining fetal origins of disease and early indicators of disease risk, developing vaccines that protect against infection, and characterizing mechanisms for nutritional and environmental effects on health. World-class research also addresses the prevention of complex and chronic diseases of adulthood faced by our aging population.

Research in the Human Health and Genomics clusters is supported by major infrastructure funding from CFI, BCKDF and Genome Canada. In particular, investment by CFI and BCKDF through the Laboratory for Molecular Biophysics, Michael Smith Laboratories, the Centre for Integrated Genomics (now the Genome Sequencing Centre), iCAPTURE Centre, the Centre for Research in Childhood Diabetes, the Center for Blood Research (CBR), the Prostate Centre at VGH, a.k.a. PC-TRIADD, the Centre for Hip Health, and the BC Centre for Disease Modeling (BCCDM).

Over the past decade, The Prostate Centre, a National Centre of Excellence, has become Canada’s leading research and treatment centre for prostate cancer and one of the largest in the world. A \$20 million CFI award added core expertise and state-of-the-art infrastructure to augment programs in genomics, proteomics, pharmacology, molecular pathology, and informatics. A developing research initiative will develop DNA-based biomarkers using Ultra High-throughput Sequencing technology to predict the risk of progression of localized disease, to evaluate response to therapy, and to help develop new therapies targeting tumours and pathways to delay the late-stage progression of disease.

The Centre for Disease Modeling (CDM) hosts a state-of-the-art bio-containment facility for the study of viruses including SARS, HIV, influenza, Hepatitis C, and West Nile Virus, each of which presents a substantial threat to human health. The major aims of research at the CDM are i) to develop vaccines that prevent infection by these viruses and ii) to develop anti-viral drugs to prevent these viruses from spreading in the body and causing disease.

Several recent initiatives enhance prior investment by building on existing CFI-funded infrastructure and expertise. These include the Centre for Drug Research & Development and the Centre for Understanding & Preventing Infection in Children. Each of these initiatives is further supported by major endowments.

The Michael Smith Genome Sciences Centre at the BC Cancer Agency is a leading international centre for genomics and bioinformatics research. Its mandate is to advance knowledge about cancer and other diseases, to improve human health through disease prevention, diagnosis and therapeutic approaches, and to realize the social and economic benefits of genomics research. The Genome Sciences Centre deploys resources and technology of a high-throughput genome mapping and DNA sequencing lab to decrypt the genetic code, specifically to advance cancer research, diagnosis and treatment.

Combining the experience of world-renowned scientists, the Genome Sciences Centre plays a major role in the fields of genomics and bioinformatics as well as various genome projects around the world. The priority of the centre is to find innovative means to automate the sequencing and fingerprinting process, develop cost-effective measures that will make such research financially viable and utilize state-of-the-art computing facilities to collect, mine, analyze and disperse data collected at this and other genome facilities. Experimental genomics is carried out on the latest sequencing and fingerprinting equipment with data collected and analyzed on one of the most innovative and flexible bioinformatics computing facilities in the world. ■

Neuroscience and Cognitive Systems

Research in this cluster seeks to address one of the greatest scientific challenges of this century: unraveling the mystery of the human brain. A central component of this cluster is the UBC Institute of Mental Health, supported by a \$20 million endowment established from private and government sources. Three research chairs in this institute complement the Provincial Leadership Chairs in Depression and in Addictions (\$5 million each). The cluster has also received seven major CFI awards, including: The Brain Research Centre, the MRI Medical and Biological Functional Imaging Centre, High Resolution Functional Imaging in Neurodegenerative Diseases, the Institute of Computing, Information and Cognitive Systems (ICICS), the International Collaboration on Repair Discoveries (ICORD, an interdisciplinary research center for promoting functional recovery from spinal cord injury that opened in 2008), a Centre for Macular Research (\$1.26 million), which exploits emerging technologies to increase our understanding of the visual system, and a Micro-PET for Functional Imaging Centre.

Examples of leadership in this cluster include a “bench-to-bedside” research approach to early intervention in psychosis, the most disabling disorder of youth and early adulthood, involving faculty and clinical investigators

Population Health, Services & Human Development

from neuroscience, genomics, radiology, psychology and psychiatry. Other interdisciplinary studies focus on the aging brain, an area of particular societal relevance as Canada's Baby Boomers enter the prime ages for stroke, Alzheimer's, Parkinson's and similar diseases.

A new research initiative will combine state-of-the-art neuroscience, molecular genetics, functional genomics, and proteomic technologies with bioinformatics to elucidate the molecular mechanisms of neurodegenerative disease processes, identify novel disease proteins and potential drug targets, and develop new drug therapies for patients.

UBC also demonstrates considerable strength in the field of neuroimaging. An emerging research initiative seeks to use molecular and cellular imaging to examine the interaction between genetic and environmental (including prenatal) factors on structural changes in the brain.

The field of biomedical engineering is of critical importance in understanding spinal cord mechanics and treating neurotrauma, and is contributing innovative solutions to these debilitating disabilities. A new UBC research initiative seeks to combine the latest advances in biological and nanotechnology strategies to develop treatments for the functional repair of the acute and chronically injured spinal cord.

Researchers in this cluster are also exploring the "learning brain" in an effort to enhance human learning and memory and to remedy learning disabilities in brain-injured children. ■

Research in this cluster seeks to translate basic research in human health into practical outcomes in health delivery and services that benefit all. The cluster is designed to compliment two of the four research areas of the Canadian Institutes of Health Research (CIHR): Health Systems and Services, and Population and Public Health.

Current research includes a focus on health and well-being in individuals and in populations, and addresses questions as to how administrative, legal, social and educational systems relate to health and development. Research in this cluster also seeks to examine the delivery of services that may have a direct or indirect impact on physical and mental well-being, and to develop activities and approaches that improve population health beyond the sphere of the health care system (i.e., in the social and educational systems).

A key strength of this cluster is the BC Linked Health Database maintained by UBC and acknowledged as the world's largest longitudinal, population-based database on health services utilization and the determinants of health. In addition, the Education Information Data Centre at UBC was awarded CFI funding to link educational data from related fields such as child development, health and economics.

Also affiliated with this cluster is the B.C. Centre for Excellence in HIV/AIDS which is dedicated to improving the health of people with HIV through comprehensive research guided treatment programs for HIV and related diseases. The Centre is a key provincial resource, serving all health authorities, regions and citizens of B.C. Research at the Centre places the disease under the microscope and promotes evidence-based social policy that helps protect people from acquiring the virus. ■

Society in Global Context

Culture and its Representation

These two research clusters are designed to foster research and scholarship that addresses social and cultural issues within Canada and beyond. Research within the clusters is focused on improving our understanding of the evolving nature and representation of culture and society from a range of disciplinary perspectives, and facilitates the examination of social and economic policy and practice in both national and international contexts.

UBC Economics is ranked the top economics department in Canada, and is in the top 25 in the world, in terms of research. In the last decade, four UBC economists have received the Rae Prize, awarded biennially to the top research economist in Canada. The Department is the administrative home to the the Canadian Labour Market and Skills Research Network and manages the British Columbia Inter-University Research Data Centre. Areas of research excellence include data-intensive economics, labour economics, international trade, and industrial organizations.

In other areas within these clusters, UBC has built strength through the recruitment of Canada Research Chairs who have established a number of centres of excellence, including the International Centre for the Study of Historical Consciousness; the Early Childhood & Literacy Research Laboratory; the Centre for Culture, Identity and Education; the Research Facility for Internationalization of Curriculum Studies; the Virtual Global Issues Research Communications Hub; the Asian Urban Laboratory; and The Political Environment, Cognitive Processes, and Citizen Competence in Policymaking initiative.

With the support of the Canada Foundation for Innovation and the British Columbia Knowledge Development Fund, the Museum of Anthropology (MOA) undertook an \$80 million expansion and renewal that has not only extended its role as a university research institution, but also broke new ground in devising inclusive and collaborative ways for museum work, interdisciplinary research and teaching across local, national, and international borders.

The Multidisciplinary Music Research Institute (MMRI) seeks to link performers, composers, and scholars with researchers in Human Kinetics, Linguistics and Speech Science, Medicine and Psychology to examine the cognitive, neurological, and physiological dimensions of musical performance and perception and their implications for physical and mental health. ■

Microelectronics, Information Technology and E-commerce

Research in this cluster builds on existing excellence and infrastructure at UBC and seeks to capture exciting opportunities in emerging areas including e-commerce, robotics, and intelligent systems, computational biology, entertainment and electronic interaction.

The \$22 million CFI award for the creation of the Institute of Computing, Information and Cognitive Systems (ICICS) has stimulated research both in this cluster and in Neuroscience and Cognitive Systems.

A new research initiative in this cluster focuses on animation and gaming, and is supported by the areas of rendering, human-computer interaction, and intelligent user interfaces. In the past eight years, CFI awards have funded heavy investments in recruitment, infrastructure and space in these areas. ■

Quantum Structures and Information

Quantum mechanics is a powerful tool for describing how the fundamental building blocks of the universe interact to form familiar macroscopic objects. Scientists and engineers at UBC are learning to translate quantum mechanics into technological developments that will help to inform the future of computer power, among other applications. Of particular interest is the ability to exploit phenomena found when materials are controlled at the atomic scale.

Research is focusing on the development of new materials and structures assembled with atomic-level control, for example using metal oxide layers to provide a technology for 21st-century information processing. Another initiative, the Canadian Center for Research on Ultra-Cold Systems, combines the research programs and infrastructure of nine UBC faculty members to study the creation, properties and technological applications of ultracold atoms, molecules, plasmas and condensed matter. ■

Nanoscience and Nanotechnology

Research in this cluster seeks to understand structures on the nano-scale and to develop devices and applications that operate on the molecular scale. The development of such applications – and the proliferation of nanoscience in recent years – is fuelled by new instrumentation that probes materials at the atomic scale. A core group of UBC researchers comprise one of the strongest Canadian efforts in this area, and an \$8.1 million CFI award to UBC and Simon Fraser University for nanostructures-related equipment are boosting efforts in this field in B.C.

UBC is a Canadian leader in composite materials research, and a \$9.8 million investment by Western Economic Development has supported the launch of the UBC-based Composites Research Network, which will establish nodes in British Columbia, Alberta, Saskatchewan and Manitoba where composites experts in academia will work with manufacturers to address industry-specific concerns.

A major research initiative in this cluster involves the fabrication as well as the theoretical and spectroscopic study of novel complex systems and nanostructured materials. The goal is to develop new approaches and understanding in the quantum theory of solids, and to define new pathways for the fabrication of materials and structures with innovative physical properties. This initiative is strongly coupled to a \$9M CFI-funded beamline for atomic-scale microscopy with applications in environmental science and advanced materials led by George Sawatzky and a \$16M CFI-funded Quantum Materials Spectroscopy Centre, led by Andrea Damascelli, which will push Canada into the forefront of research into the electronic properties of novel material, with applications including high-performance computing and energy storage technologies. ■

Origins and Mathematical Structure

Research in this cluster seeks to address the basic questions of existence, offering exciting challenges to UBC astronomers, mathematicians and physicists: *What is the universe made of? How did it begin and how will it end? How did our own solar system form? Is there life elsewhere?* Seeking the answers to these and similar questions serves to pique public interest, to enhance students' appreciation of science, and to elevate Canada's international status in science and technology.

UBC has considerable strength in this cluster. It is an important participant in several collaborative experiments to decipher the large-scale structure

Sustainability / Environment

of the universe by measuring the cosmic microwave background. Strength in stellar astrophysics will also blend well with the proposed initiative in planetary astrophysics. UBC also excels in core mathematics research; the probability research group is considered among the top three in the world.

In 2003, UBC established the Pacific Institute for Theoretical Physics (PITP) to support research in three related clusters (Origins and Mathematical Structure, Nanoscience and Nanotechnology, and Quantum Structures and Information). This international research institute is based at the UBC but it sponsors research networks and international research collaborations. ■

UBC's institutional commitment to sustainability, outlined in the strategic plan *Place & Promise*, broadly influences and combines activities in research, teaching and learning, and campus operations. Answering critical research questions in sustainability requires bridging the traditional university disciplines. Research in this cluster seeks to (i) investigate human impacts upon the physical environment and develop sensitive indicators of environmental change (ii) create technological innovations and shape policies to reduce environmental deterioration and its impacts on humans and (iii) integrate knowledge in order to better understand, and address, environmental issues.

Seven UBC faculties (Agricultural Science, Applied Science, Arts, Forestry, Graduate Studies, Law and Science) participate in this cluster. This diverse research cluster has benefited from a number of CFI-funded infrastructure facilities including the Aquatic Ecosystems Research Laboratory, the Earthquake Engineering Research Facility, and the Clean Energy Research Centre, Centre for Higher Order Structure Elucidation, Geophysical Disaster Computational Fluid Dynamics Centre. In 2011, UBC unveiled the new \$36 million Center for Integrated Research in Sustainability and the \$41 million Beaty Biodiversity Centre, which includes the Biodiversity Research Centre and the Beaty Biodiversity Museum.

A new research initiative in water and sustainability seeks to pair UBC's globally renowned water scientists with policy experts to establish sound water governance and policies that manage and steward the planet's most important natural resource. Building on UBC's demonstrated excellence in fuel cell technologies, another new research initiative seeks to improve the commercial viability of fuel cell technology. ■