ERA-Instruments
An ERA-Net initiative for promoting infrastructure funding in the life sciences

ERA-Instruments WP 4
Interaction with scientists

Task 4.4
Gaining and spreading information

Deliverable D4.5
REPORT ON STUDY TOUR TO CANADA

Task leader
ENEA/CNR

March 2010

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Authors: All the participants to the study tour
Edited by: S. Usai and K.M.H. Maessen,
Netherlands Organisation for Scientific Research (NWO), The Netherlands

Please note that all the figures given in the document are in Canadian dollars ($)

1 Executive summary

With a delegation composed of both members from the scientific community (the members of the Scientific Advisory Board) and from the research funding organizations (the ERA-Instruments partners) we visited eight Canadian research funding organization and research institutions. Our general aim was to get a picture of the research funding in Canada with special emphasis on infrastructures: how it works, what are the strengths and weaknesses and how it does compare to the European research funding, seen from both the perspective of funding agencies and researchers.

Based on our impressions from the visits to these institutions, we draw in this report a number of conclusions, which can be summarized as follows. Canadian funding is quite fragmented, although for research infrastructure the Canadian Foundation for Innovation plays the main role. Funding is strongly linked to the research areas identified by the government as priorities, with the drive towards economic and social welfare of the Canadian population as the ultimate goal of research. It has mostly a short-term character (max 5 years) and this, combined with the fact that government funds have always to be matched by larger (!) funds from other sources, constitutes a motivation to develop strong links with industry, at the level of cooperation on R&D as well as of renting staff and/or infrastructure to firms. Staffing is another relevant issue in the Canadian research world, showing similarities with the European case. Interesting measures have been taken recently to counteract the “Brain Drain” of Canadian researchers to the United States and to attract researchers from abroad. And the hiring, training and keeping of highly skilled technicians is also felt as a major problem in Canadian research institutions, as the possibilities of career advancement for this category are less than with respect to the academic careers and the funding sources themselves are limited.

2 Introduction and acknowledgments

This document is a report of the study tour to Canada organized in the framework of the EU-FP7 project “ERA-instruments funding in the Life Sciences”.

Objectives of ERA_instruments are:

- To create a network of stakeholders for instrumentation funding for life sciences
- To set up comprehensive tools for adequate treatment of instrumentation related topics surveys, user workshops, study tours, identification of emerging Research Infrastructure needs, ...
- To foster contacts with scientists

The focus of ERA-instrument is on midsize bio analytical instrumentation, of typically 500 k€ to ~20 M€, i.e. NMR, MS, microscopy, micro-array platforms, post-genomic high-throughput techniques, etc.

This report starts with an explanation of the goals of the tour, in the following section; the details of the tour programme and participants are given in Appendix. A short overview of the research and funding landscape in the life sciences in Canada (section 3) is followed (section 4) by a series of reports, one for each visited institutions, compiled by the different members of the delegations on the basis of the meetings and discussions with representatives from these organizations.
On the basis of these reports, we finally tried in section 5 to summarize the most interesting observations about life sciences research and funding in Canada.

Acknowledgments
Organizing a study tour to another country in a few months requires not only a considerable amount of time and efforts, but also the knowledge of what are the places you should visit and the persons you should talk to. Also, the organizations must be contacted and the meetings arranged and everything must fit in a week’s programme.

All of this would not have been possible without the assistance of our representatives of the Science and Technology Office of the Royal Netherlands Embassy of Washington DC and of the Royal Netherlands Embassy of Ottawa. On behalf of the participants of the study tour and also of all the ERA-Instruments partners, we would like thank them, and all the other people at the two embassies who contributed in the organization of this tour.

We are really grateful to Barbara Staals, Paul op den Brouw and Philip Waal for their precious help in preparing the tour. A special thank to Philip Waal of the Royal Netherlands Embassy of Ottawa for acting as our host during our stay in Ottawa and Montreal, and to Barbara Staals for travelling with us to assist us during the whole tour.

We have learned a lot, thank you!

3 Approach: ERA-instruments study tour issues and procedures

Goals
Life sciences in Europe have a strong background with decentralised facilities. This situation is believed to be a strength of the European Research Area. However, we need to

- know about other concepts of how to run facilities.
- establish a directory of infrastructure funding in life sciences in non-EU countries.
- get into contact with scientists from non-EU facilities (America, Asia, etc.), which is regarded as mandatory for the European countries' research policies. Correspondingly, study tours to (non-EU) cutting edge facilities with selected administrators and related scientists are proposed.

Those study tours will enable partners to:

i) create a connection to core laboratories involved in cutting edge research in life science,
ii) evaluate the state-of-the-art of host institutes facilities and compare with that of ERA-NET partners,
iii) identify potential collaborations and extend the network.

Procedure
The tour was organized by the ERA-Instrument partner NWO, the Netherlands Organization for Scientific Research, assisted in her task by the Netherlands Office for Science and Technology, Royal Netherlands Embassy, Washington DC (USA).
The tour programme (see next section) comprised visits to both research funding organizations as well as research institutions. The visiting delegation comprised both scientists members of the Scientific Advisory Board, representatives of the Funding Agencies participating in ERA-Instruments and representatives of the Science and Technology Office of the Royal Netherlands Embassy of Washington DC and of the Royal Netherlands Embassy of Ottawa.

Issues addressed during visits at research facilities

- Basic data of the research facility
    - Figures and facts (Number of employees, size of facility, date of foundation, core support etc.)
    - Management structure
    - Relevance with respect to national/ international context
- How is the funding of infrastructure organised?
    - Which options for funding are available?
    - Application based?
    - Maintenance costs: which expenses are covered (running costs, update costs, service contracts)
    - Personnel involved?
- Recent trends/challenges for life science facilities
    - What challenges are visible for the funding of high level life sciences facilities?
    - How is the need for high level trained staff handled?
    - How are new technologies developed?
    - How to get access to the newest technologies?
    - How do you offer access to your facility (internal/external)
    - Co-operation with other institutes
    - Co-operation with European/international programmes?
    - Technology development – basic research
    - Intellectual property rights
    - Interaction with companies/industry

Issues addressed during visits at research (funding) organisations

- Basic data of the research (funding) organisation
    - Figures and facts (Number of employees, size of facility, date of foundation, core support etc.)

    - National policy/ roadmap
    - Relevance for the countries research promotion
    - Dependencies/interactions with other organisations/government
- What type of funding schemes can be provided?
    - Which options for funding are available?
    - Which expenses are covered (investments, running costs, update costs, personnel)?
    - Any recent changes for the funding?
    - Can the funding include non national actions?
- Decision process
    - Who can submit new ideas on infrastructures?
    - Application?
    - Review process
    - Decision process
    - Monitoring/ evaluation
    - Time required for the process?
    - Frequency of the calls/decisions?
- Recent trends/challenges in research/infrastructure promotion
    - What challenges are visible for the funding of high level life sciences facilities?
    - Regional centres vs. national centres?
    - (National) roadmap for bioanalytical RIs?
    - How is the need for high level trained staff handled?
    - Support for young researchers?
    - How are new technologies developed?
    - How to offer access to the newest technologies?
    - Co-operation with European/international programmes?
    - Technology development – basic research
    - Intellectual property rights
    - Interaction with companies/industry

4 Life Sciences Research in Canada: a short overview

Research
With respect to the Life Sciences, Canadian research has an important role in Genomics and Proteomics, vaccines and immunotherapeutics, regenerative medicine, stem cell research and drug formulation and delivery systems. It follows quite naturally that the biopharmaceutical research is also very strongly developed, together with biomedical instrumentation development. With more than 390 pharmaceutical and 400 biotech companies, Canada is the country with the third-largest number of biopharma firms in the world.

Funding
Although very active in all fields of research, Canada has no Department of Research at the governmental level. The federal research policy and funding is managed by the Department of Industry through the Ministry of State for Science and Technology.

With respect to Canadian Life Sciences, the Funding (http://www.ic.gc.ca/eic/site/lsg-pdsv.nsf/eng/Home) is distributed to a number of federal organizations:

- Canadian Institutes of Health Research (CIHR)
- Genome Canada (GC)
- Canadian Foundation for Innovation (CFI)
- National Research Council (NRC)
- Industrial Research Assistance Program
- Natural Sciences and Engineering Research Council (NSERC)
- Networks of Centres of Excellence (NCE)

Current funding decisions by federal agencies are aligned to the government's Science and Technology Strategy, which was published in May 2007. One of the main goals of this strategy is to increase the collaboration between Canadian research institutions and industry to increase the private sector's involvement in R&D. Also, the Department of Industry offers a wide range of instruments to strengthen the collaboration between research and industry in the Life Sciences and to encourage the technology transfer. Not only for the life sciences, but for research in general, there is a strong drive towards application-oriented research. A very strong focus is set on the improvement of Canadian economy and on wealth and health of the Canadian population and environment. The pressure on research and research funding organizations in Canada to align to these priorities is also very strong.
Besides federal funding, also provincial funding is available for research. Most of provincial funding is used to match federal funds like those from CFI and Genome Canada. There are however also some provincial funding programs, and many scholarships and fellowships. The amount of provincial funding varies depending on the extension and also on the economy of the province, and might be considerable: the Ontario Research Fund of the Ontario Ministry of Research and Innovation, which covers acquisition and operational costs for life sciences-related research infrastructure, amounts for example to $730 million over four years.
On 4 March the Canadian Federal Government published the federal budget for research for 2010-2011. With respect to the budget of last year, which was very heavily criticized by the community because of the severe cuts, the budget of this year is higher. However it is not at the level of the previous years, according to the critics. With respect to the Life Sciences the budget comprises a $75 million lump sum to Genome Canada, $48 million over 2 years for the development and use of medical isotopes, and a $32 million annual boost for the three main Canadian granting councils – the Natural Sciences and Engineering Research (NSERC), the Canadian Institutes of Health Research and the Social Sciences and Humanities Research Council of Canada (source: Nature 457, 646; 2009).

5 Reports on the visited organizations

5.1 NRC Strategy and Development Branch

NRC Headquarters, **Ottawa**

Website: http://www.nrc-cnrc.gc.ca/eng/about/strategy-development-branch.html

Participants:
- Alexandra Dagger MBA, Director, Planning and Performance Management, Strategic and Development Branch
- Dr. Bruce Baskerville, Manager, Strategy Development, Planning and Performance Management, SDB
- Dr. Jean-Robert Brisson, Director of Immunobiology, Institute for Biological Sciences

Report by: Cas Maessen

Basic facts

The National Research Council (NRC) is a Canadian Research Agency established in 1916. The NRC consists of 17 research institutes in all science fields divided over Canada. The NRC is a Federal organisation with about 4300 employees and 1500 guest workers. The total expenditure in the year 2008-2009 was M$ 899 (M€ 5850). The income from contract research, licences and patents in the same period was M$ 156 (M€ 100).

The NRC institutes cover three research fields, namely:
- Life Sciences
- Physical Sciences
- Engineering Sciences

In the field of Life Sciences there are 5 institutes:
- Institute for Biological Sciences
- Institute for Marine Biosciences
- Institute for Biodiagnostics
- Biotechnology Research Institute
- Plant Biotechnology Institute

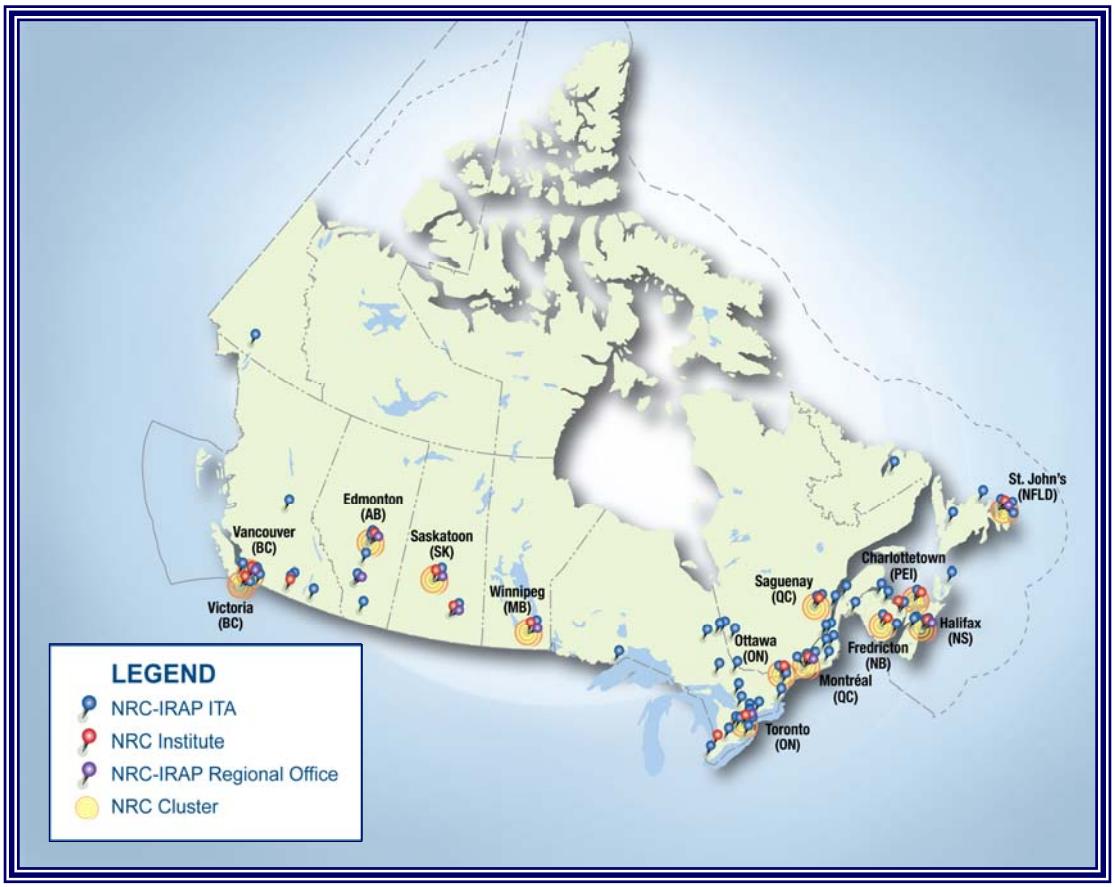
Strategy
NRC aims at providing integrated science and technology solutions in areas of critical importance to Canada.
Within the strategy three goals are defined:
1. To contribute to the global competitiveness of Canadian industry in key sectors and to the economic viability of communities
2. To make significant contributions to Canada's priorities in health and wellness, sustainable energy and the environment – areas critical to Canada's future
3. To strengthen Canada's innovation system

In order to achieve this goal the NRC focuses on the 8 Canadian key industry sectors (listed below), regional and community innovation, national priorities and national science and innovation initiatives.

Present strategic plan
In order to define the present strategy an inventory was made of topics which are
- Important to the Canadian economy
- Research essential for their success
- Sectors where NRC can make a significant contribution

This leads to three areas in the field of NRC institutes
- Health & Wellness
- Sustainable Energy
- Environment

An inventory of the federal government came up with the same topics which confirmed the NRC inventory. Within this field 8 key industry sectors are defined:
Aerospace, Agriculture, Automotive, Manufacturing, ICT, construction and within the life sciences Bio-Pharma and Medical devices.



Funding schemes provided

NRC is an institute organisation and has no funding schemes. In the past also research funding was part of the organisation. At present the research funding is part of the federal research council NSERC

The NRC relies complete on direct federal funding and income from contracts. Canadian regulations do not allow the NRC institutes anymore to request for funding from the research councils. Due to the fact that most senior researchers from the institutes are also appointed at a university, the individual researchers have an option to apply for funding from the research councils. In several cases the proposals granted by the councils are (partly) executed at an NRC institute. The NRC has a strong link with universities and sometimes institutes are on the university campus.

Over the years the share of NRC in the Canadian research is considerably reduced due to the rise in the budgets for universities and the establishment of several research councils devoted to university research. It seems like there is a political preference for university research at present.

The NRC can plea at the federal level for additional funding for programmes. By this way the Genome and Health programme is funded. This is a separate programme next to the Genome Canada programme.

The NRC institutes are strongly devoted to cooperation with other partners (national and from abroad) and industry. In the period 2008-2009 in total 477 agreements were signed with a value of M$ 372 (M€ 241).

Decision process

The NRC developed an integrated planning system. The institutes individually make their own business planning. The Senior Executives Committee decides on the plans of the institutes and their budget claims. The criteria used are considered confidential. In general about 85%- 95% of an institute's budget is fixed and 15%-5% can be used for changes in the programme. New programmes are implemented slowly.

For major initiatives (>M$ 0,5 = M€ 0,32) a special major initiatives committee which judges about the requested initiatives.
This decision making process is an internal process executed without external/foreign peer review.

The federal government executes a strategic review of the NRC every 4 years. During this review a comparison is made with the national priorities, the relevance for Canada and the level of the research. In this review every institute has to indicate where to cut 5% - 10% of the budget. The NRC has to plea again for retaining this budget. This federal exercise has the effect that changes in the institutes are slowed down.

Recent trends and challenges

Due to the fact that the institutes are not allowed to apply for funding from the research councils and the major founder of infrastructure is the Canadian Foundation for Innovation, the budgets of the NRC are really under pressure, also because some larger programmes will end in the near future.

In general the groups in the institute are rather small and cooperate intensively with other groups. The team work is promoted very much as well in publications as in the distribution of the income from licences and contracts. Due to the smaller groups and available expertise the institutes are able to respond flexible to request from partners or industry.

Regional centres vs. national centres?
In Canada the institutes have a regional spread, with in some cases duplication of expertise

IP
The NRC institutes are responsible for the IP. There is a central business support unit which assists the institutes in bringing knowledge to the market. The general policy is that 25% of the income goes to the lab of which a part to the inventors. 75% of the income goes to the NRC.

Staff
There is competition for qualified staff within Canada between NRC universities and companies. There is also a strong influence of the US. Especially the recent stimulation of R&D by the US is considered as a thread for the Canadian staffing.
There is limited space for new young staff. In general NRC trains staff for a future career in industry.

New technologies
The development of new technologies is for an important part driven by the requests from customers. In general NRC co-operates with other institutes and shares facilities.

5.2 NRC Institute for Biological Sciences (NRC-IBS)

NRC Headquarters, Ottawa

Website: http://www.nrc-cnrc.gc.ca/eng/ibp/ibs.html

Participants:
- Dr Jean-Robert Brisson, Director
- Dr Yves Geoffrion, Business Officer
- Dr Jianjun Li, Research Officer
- Dr Harold Jarrell, Research Officer
- Dr Susan Twine, Research Officer
- Dr Jennifer Hill, Research Officer

Report by: Michael Ball

Basic facts

The Institute for Biological Sciences (IBS) is one of 20 institutes of the National Research Council (NRC) of Canada. The IBS centre visited is one of two IBS sites, the first site (where the visit took place) located within the NRC headquarters at 100 Sussex Drive, Ottawa, and the second situated on Montreal Road, also Ottawa. The research focuses of the two sites are in the application of neurobiology, immunology, and glycosciences to reduce the impact of age-related and infectious diseases. The IBS has a core group of 250 multidisciplinary scientists, 180 of which are full time, 20% are visiting workers. The scientists are employed directly by the NRC and are effectively civil servants, although academics often hold adjunct positions at universities. The IRB is under the direction of the NRC Vice President for Research Life Sciences (currently Dr Roman Szumski).

The Sussex Drive site where the visit took place focuses on the immunobiology and glycobiology aspects of the programme. The strategy of the programme is targeted to collaborating and supporting industry and commercializing products. In the Canadian context this means collaborating with SME's. The generation of patents and IP is considered as part of the assessment of the outputs of NRC-IBS researchers, even more so than publications. The strategy of the Institute aligns closely with that of the NRC itself.

Funding schemes provided

For infrastructure and instrument funding, the costs are provided from the NRC itself. NRC scientists are not eligible for funding from the three funding agencies, nor are they eligible for funding from the Canada Foundation for Innovation (CFI). However, as previously mentioned, academics employed by the NRC often hold adjunct positions at universities, making them eligible for these other funds. NRC staff has successfully partnered university researchers in making CRI applications, for example a recent successful bid for a 900MHz NMR where NRC technical staff installed and built the machine which was situated at a university and operated by university staff. NRC itself employs core staff on long term contracts, so equipment can be maintained and serviced by experienced technical staff. Equipment is generally run as a service for other NRC staff and researchers rather than being a pay-for-service from external researchers. This varies between institutes – for example, the institutes focused on aerospace do service work for industry.

Decision process

Scientifically, The NRC-IBS scientific strategy is driven by the strategy of the NRC. The current research strategy focuses on neurobiology, immunology and glycobiology. The priorities are identified at a high level, and then followed by the institutes. Programmes that are scientifically successful can be ceased if they are not considered as strategically relevant. Staff employed within these areas can either be redeployed within the organisation, or released. These staff often finds work in companies or universities locally. Current research programmes show some diversity with projects covering antibodies with increased solubility (derived from Llamas), improved

adjuncts derived from extremophile bacteria and projects to improve the enzymatic breakdown of plant fibres for biofuel production.

Recent trends and challenges

NRC-IBS staff indicated that there were difficulties in attracting the best researchers to come to work in the NRC institutes. This was attributed to restrictions in group size within the NRC institutes; academic groups tend to be made up of one researcher, plus one or two technical staff, plus a research assistant. High-ranking academics may be used to, or prefer, operating with much larger groups of PhD students and multiple post-doctoral research assistants, and hence may find working within the institute environment too restrictive. In addition, hiring can be a long process. New personnel tend to be trained from the bottom up, with entry through postdoctoral programmes, summer studentships or co-operative programmes. A Research Associate Programme also exists, that has recently been extended from three to five years. In addition to the NRC research officers (RO), the institutes also have a number of research council officers (RCO) who are active in outreach and business activities and who support the research activities. Technology development within the IBS is limited, but methods development does occur. A number of rare or unique technologies exist, such as single domain antibody technology, or pathogen fermentation. Intellectual property is divided between institute, laboratory and inventors and innovators if the income is over $1 K, with 50% going to the institute, 15% to the laboratory and the balance being split between the inventors and innovators. The identity of the inventors ad innovators are identified at the start of the process and each person involved is assigned ‘points’ depending on their involvement in the process. The points they are allocated will determine their share of any revenue that accrues. Institute wide e-mail are circulated to alert researchers of the possibility of product patenting to see if anyone else considers that they should be included as an inventor or innovator. The NRC –IBS accrues considerable income from licenses – up to $4 million per year. Of this, $1.4 million is generated by licenses for a Meningitis C vaccine.

The driving force behind collaborations with external organisations is a where there is an established research need. Collaborations exist between other universities, through different mechanisms, for example student exchange. International collaborations also occur, and are an NRC aim.

5.3 Canada Foundation for Innovation (CFI)

CFI Office, Ottawa, ON

Website: http://www.innovation.ca/en

Participants
- Dr. Eliot A. Phillipson, President and CEO
- Jac van Beek, Vice-President, Programs and Planning
- Manon Harvey, Vice-President, Finance and Corporate Services

Report by: Stefania Usai

Basic facts

The Canada Foundation for Innovation (CFI) was founded in 1997 by an act of the Parliament. The background reason was the need to assure funding for research infrastructure on a structural basis, the feeling being that infrastructure was getting obsolete because the funding had been neglected in the 80's and 90's.

The organisation has a temporary character and this is stressed also by the fact that it was created outside the federal department of Industry– in the current arrangement the organization will cease to exist when the funding flow ceases. Despite its temporary character however the funding flow to CFI is currently still large, so there is no signal at this moment that CFI could cease to exist on the short term.
The aim of CFI is to provide funding of research infrastructure (RI) in the Canadian public non-governmental sector – note that NRC is thus not eligible for funding by CFI.
The mandate of CFI covers all research fields. Further, CFI is following in the last times the trend of the government, which is pushing towards multidisciplinary research and cooperation with industry.

CFI is and independent foundation which has an agreement with the government to manage a large amount of funds. The government appoints 7 of the 15 Directors. Another group of 15 Members, representing the broad range of Canadian stakeholders, appoint the remaining 8 Directors. This means that the government does not influence the granting process, which is a responsibility of the Board; this is important especially when considering the possible political pressure on CFI with respect to awards of large grants, such as the $56 million grant awarded by CFI to the Canadian synchrotron.

Strategic priorities
Commissioned by the government to define priority fields, CFI identified the following 5 fields:
- ICT
- (Health) Genomics
- Energy
- Environment
- Material Sciences

The first 4 became actually the strategic priorities of the government. The definition of strategic priorities does not mean that there is no attention for emerging fields, and the government has guaranteed CFI that they do not need to restrict to the identified areas. Besides, these are already the fields where CFI is investing most of the funds. The government is becoming more directive, but not with a tag on the funds for each field - negotiations on this are however still going on.

Funding schemes provided

The 2009 federal budget allocated $750 million to CFI, bringing the total government allocation to CFI since its inception to $5.2 billion. Of this $750 million, $150 million was added to the 2009 Leading Edge and New Initiatives Funds Competition; $600 million is intended for future activities of the CFI, including the launch of one or more new competitions by December 2010.
Funding is allocated on a multiyear basis.

Funding by CFI to the institutions amounts to up to 40% of the total eligible costs, and the remaining 60% must be provided as matching by the institutions themselves. According to CFI, most institutions usually manage to have 40% of this 60% matching paid by the provinces and they pay themselves the remaining 20%, which they usually link to projects with the industry. In some cases industry pays even more that this 20%.

CFI is the first funding organization where applicants are not single researchers but institutions. Also –and this was a real innovation in Canada – in order to apply, institutions have to submit their strategic plan, which actually forced many institutions to develop one! All the proposals have to be aligned to this strategic plan.

Leading Edge and New Initiatives Funds Competition
This is the largest competition and although it is run as one competition, it comprises two granting streams:

- New Initiatives Fund (NIF), for innovative directions which have not yet been funded by CFI. Assessment is based on potential of innovation.
- Leading edge Fund (LEF), which is limited to previously granted projects and is intended as a follow up ("building on strengths"): in this case assessment is based on the check of past performances: applicants have to show what they have done.

Leaders' Opportunity Fund
This program is different from the other programs, which are based on national competitions. Canadian universities suffered a brain drain to the USA. New faculty members starting up need basic equipment to start up their activities, but most Canadian institutions cannot provide as much resources as the US universities. The universities have therefore a fund to attract talent on a fast basis. The Leaders' Opportunity Fund (LOF) has three rounds per year: a university submits a name of a person to be recruited but has already an allocation of funds for the purpose. If CFI does not approve the proposal, the university does not lose the fund, but can try using it for the next candidate.
The budget is up to $1 million per application, which is considered a fair amount for a starting assistant professor.
This system contributes significantly to the "brain gain". Allocations to institutions are on a 3-year basis and are weighed on performance of the university. They vary from $300.000 for a small university to $10 million.
The advantage is that universities are not competing against each other for this fund but simply managing their budget strategically. This means that they don't need to rush to use the money, but may choose their own timeline. Notice that the money is for infrastructure to the research chair; still it can be called a "people fund". The candidates are screened on quality by a standing review panel.
Notice that the LOF is actually intended not only for new promising researchers, but also to retain already employed scientists who have already a leading position in their research field.

Decision process

As already mentioned, in order to apply institutions have to submit their strategic plan, which all the proposals have to be aligned to.

Submission of proposals
With the proposals CFI asks for a business and management plan, but looks also at the operational plan and the maintenance plan – especially for larger RI's.
CFI looks very deep in the management plan of large projects. Large projects have to be not only multidisciplinary, but also multi-institution: examples of these projects are the synchrotron and the national computing network. The risk being of course that some will put up cooperation just for sake of the proposal and then split up the money after granting, but reviewers usually see through it.
Re-submissions are allowed for improved applications, and the reviewers' comments are taken into account.

Institutional cap
In the competitions there is an upper limit to the budget that can be asked. It turns out that this is a good instrument to discipline the budget at universities, which will have to dedicate the money in a

well-though allocation. This means also that CFI keeps aligned with the changing management schemes of institutions.
The limit for each institution ("institutional cap") is based on the product of the total fund with a weighing determined on the last 3-years of research funding attracted by the university. The cap is generous, so it is not terribly restrictive, but it forces the university to organize their own submissions, for example with an internal competition. There is one exception when you can exceed your cap, and that is when it is in the framework of collaborations, for regional as well as for international projects. Also, institutions can exceed the cap if they submit only a single application to a given competition.

Assessment
International review is used. About 40% of the reviewers are from abroad.
Assessment criteria are exclusively based on excellence and not in any way on regional or other formulas.
These criteria are:

1) Worldwide value
2) Multidisciplinarity
3) Education and training component (i.e. "human" component)
4) Institutional commitment: not only the strategy but also the situation at the institution is checked. For example, each institution has an allocation of chairs, equipment and RI, and if the institution has not allocated much of these, this gives also a clue.
5) Benefit to the country: this does not mean that there has to be a product – consider that CFI is financing the Southern Neutrino Observatory – but CFI has a mandate also on technology and needs to keep that into account.

In particular the introduction of the multidisciplinarity criterion by CFI seems to be affecting the universities, despite their department structure by tradition.

Granting rules
When CFI awards the grant, they also make an agreement with the institutions on how the cash will flow. The institutions have to demonstrate that they have reached the milestones as agreed to get the next instalment of the funding. In other words, CFI actually manages the grant. This means by the way that CFI also gets the interests on the grant, which is also put back in the research funds. In conclusion, we can say that CFI has a much more active role in granting than other funding agencies that simply "write the check".

CFI approves the timeline of the funding and grants 40% (never more) of the needed budget.
Also, CFI asks for a yearly report. Once the infrastructure is acquired CFI asks for a final financial report, when the RI is up and running, to close the books.
Also, CFI asks every year - for five years - a progress report and an institutional report, where the impact of the funding has to be described. Moreover, monitoring visits are organized each 3 year to review the research, finances and management of the funded facilities. Additionally, a continuous financial monitoring of the project is performed.
In case of delay the control starts from informal check and proceeds to a site visit of the project officer for evidence of the delay. In more serious cases the process escalates and it might end up on conditions defined by CFI to be met for further funding.
Control is based on a one-to-one contact line – CFI research officers have each their own portfolio of institutes and also at the institute they have one contact person.

Operational costs
CFI finances the running costs only once; the financing amounts to 30% of the 40% granted contribution to the capital costs (i.e. 12% of the capital costs), and this will usually cover the running costs for three to four years. After that institutions have to take care themselves of the running costs, looking for funds in other ways. The amount is placed as a single allocation and the institution is free to divide it among their projects as long as these are CFI funded. The funding of running costs is related to direct costs only – so for example you can pay the technicians needed to run the facility but not the electricity or other, more generic personnel. This is sometimes a problem for database RI's where the line between direct and indirect costs is less defined.

Recent trends and challenges

Question: Does CFI work top-down? For example in the case of the national computing facility?
No, this initiative was called for by the community. They came together and made a plan for a national network, and then they went to CFI with the case for a national system. The assessment was done not only with international reviewers, but also the community not involved in the project was asked whether the project would fit their needs.
For this project they receive an extra 30% budget once for operational costs.
Note that in this case there was no national competition. National competition servers only for excellence: in this case however it was not necessary, as it was a question of excellence with respect to the international standard – therefore the international panel of reviewers.

Outcome Measurement Studies (OMS)
The Outcome Measurement Study (OMS) is the main accountability instrument used by CFI to assess the contribution of the own investments to the national strategic goals in research policy. In order to evaluate the output of financing CFI infrastructure, CFI has developed a set of 6 specific indicators that are applied to a specific theme within an institution. The assessment consists of a questionnaire and a visit by an international panel. The evaluation is not performed on single projects, but regards the whole set of projects of the specific theme. The assessment considers the impact of all funding on the theme, including also funding from other sources. In other words, the reviewers look at the whole picture of the theme and not only at the grants from CFI. Other funders are also invited to participate in these reviews, to optimize the reviewing processes.

International participation of CFI
Half of the CFI's International Fund budget was dedicated for programmes in Canada to attract international research. They have to be large programmes, and international partners did not have to contribute to construction costs, but they have to declare that they will support their own users. Examples of international projects are the neutrino lab and the Canadian research icebreaker, the *Amundsen*. CFI has funded 100% of the costs of 4 projects, for a total of $100 million.
Another $100 million was in the past dedicated to applications for participation to projects abroad, the funding being called International Access Fund. Examples of participation in international projects abroad are the Hawaii telescope, of which CFI has paid a 15% portion to guarantee a 15% Canadian participation; and in the infectious disease facility in Nairobi, sponsored by the University of Manitoba.
Currently there is no longer distinction between national and international programmes: for example, CFI financed the Canadian Tier 1 Center of CERN and the participation to ATLAS through the regular competition.

Intellectual Property Rights (IPR)
CFI does not participate in IPR and leaves them to the institutions and commercial partners. CFI only requires that there is in place an IPR system, as well as ethics review. CFI is indeed especially mandated not to ask for IPR, not only because they are a public organization, but also because a) they do not fund research and b) their funding amounts to max 40% of the budget.

5.4 Natural Sciences and Engineering Research Council of Canada (NSERC)

Ottawa

Website: http://www.nserc-crsng.gc.ca/index_eng.asp

Participants:
- Marie Claude Caron, Manager, Policy & International Relations
- Pierre Bilodeau and Serge Villemure, Directors of Research Partnerships and Research Grants

Report by: Benoit Dardelet

Basic facts

The Natural Sciences and Engineering Research Council of Canada (NSERC) is an agency of the Canadian federal government created on May 1, 1978. The main purpose of NSERC activities is to support Canadian research and achievements. It is a granting agency (does not conduct research and has no research facilities) and it is governed by 21 members appointed by the government. It has nearly 400 employees (in 2009) located at the headquarters in Ottawa and at the 5 regional offices in the Atlantic, Ontario, Québec, Prairies and Pacific regions.
The NSERC budget amounts to $1,054 billion in 2009; of this budget, 5% is for the own administration, the remaining budget is spent to finance Canadian research.
NSERC as an organization is a spin-off of NRC (National Research Council) and its activities are in the sector of Science and Technology. It supports research across disciplines and has many common programs with industrials.

Canada's Research and Development Priorities and Sub-priority Areas
- *Environmental science and technologies* (water, cleaner methods of extracting, processing and using hydrocarbon fuels, including reduced consumption of these fuels).
- *Natural resources and energy* (energy production in the oil sands, Arctic (resources, production, climate change adaptation, monitoring); bio-fuels, fuel cells and nuclear energy).
- *Health and related life sciences and technologies* (regenerative medicine, neuroscience, health in aging population, biomedical engineering and medical technologies.
- *Information and communication technologies* (new media, animation and games, wireless networks and services, broadband networks, telecom equipment).

Dependencies/interactions with other organisations/government
One example of partnership is the Canadian Barcode of Life Network project which is primarily funded by NSERC as Strategic Network Grant along with with NRC, CFI, Genome Canada – this latter is a collaboration for the funding of the; it has also industrial connections through the Bioindustrial Innovation Centre (BIC).
NSERC cooperates also with 3 granting councils for health (CIHR), and the social sciences and humanities (SSHRC) and,by organizing joint meetings and developing common strategies.

Funding schemes provided

NSERC has 3 main priorities/funding streams:
- "People" for building on human capital in the natural sciences and engineering (NSE).
- "Discovery" for unleashing the creative power of the researchers.
- "Innovation" for seizing strategic opportunities for Canada and realizing the benefits of research in industry and society.

Within the priority "People" NSERC finances undergraduate and postgraduate scholarship, research fellowships, Canadian chairs as well as NSERC ones for a total of $323 million (in 2009) NSERC also finances research conducted on large equipments, but does not own them.

Under "Discovery", NSERC's Discovery Grants are intended for long term funding of ongoing research. The total budget for this stream is $410 million and the main program is the Discovery Grant. It is a 5-year grant, after which researcher can re-apply for another 5 years, the applications being judged on the basis of achieved results. The grants are intended only for direct costs of research, not to pay the applicants' salary- but he/she can hire PhD and Postdocs with the grant. There is no limit for the renewal of the applications. The Discovery Grants can also be used for equipment up to $7.000. For more expensive equipment the funding is provided, also within the Discovery priority, through the Research Tools and Instruments Grants Program (budget is $5.8 million). Specifically targeted to national or international facilities is the Major Resources Support Program ($33.9 million), which is intended on one side to facilitate the access to these facilities to Canadian researchers; and on the other side to finance the running costs of the facilities (salaries of the personnel included).

More details on the Discovery Grant from NSERC's Website can be found at:
http://www.nserc-crsng.gc.ca/Professors-Professeurs/Grants-Subs/DGIGP-PSIGP_eng.asp

As for the priority "Innovation" there are 4 main streams at NSERC:

- Strategic Partnership Programs ($122 million)
  It forms networks between academic researchers, industry and government. The program offers strategic workshops, strategic project grants and strategic network grants. Financed for a 5-year period with $1 million/year.

  The Strategic Workshop Program (SWP) seeds new collaboration between academic researchers, industry and government. The grant is <$25 K for the first year. All expenses covered.
  The Strategic Project Grants Program (SPG) are intended to increase the participation of Canadian based companies and/or government organisations in academic research. However, applicants are encouraged to incorporate international collaborations into their proposals of research and training in target areas. All expenses covered.

  Finally, the Strategic Network Grants are for large scale multi-disciplinary research projects in target areas. NSERC funds for 5 years between $500K and $1 million annually. All expenses covered.

- Industry-driven Programs ($72 million)
  It is a market-driven research program, with universities and industrials sharing project for 50% each. This $1 million/year project supports 1 chair-holder from industry at the university, with the purpose to create a critical mass of researchers for a research program of interest for industry and has to be incremental, i.e. it has to be a newly created chair.

- Tech Transfer/commercialisation programs ($10 million)
  It is a capacity building support and "proof of concept" project. Financed for 5 years, it includes the salaries.

- Industrial scholarships ($14 million)
  For any undergrad – post grad or post doc in industry.

Networks of Centres of Excellence (NCE)
At $10 billion/year, universities represent 1/3 of Canada's total R&D expenditure. So in 1989 the NCE program was created to mobilize Canada's research talent in the academic, private and public sectors to develop economy and improve quality of life of Canadians. There have been 39 NCE supported and 17 ongoing in 2009. There are various models of NCE, including 17 for Commercialisation and Research (CECR), 4 for Business-led (BL-NCE) and 1000 Industrial Internships/year. They used to be 7-year projects renewable once, they now are 5-year projects, renewable once but including now a 3rd partner-driven term.

International cooperation
By enabling an open research environment, international collaborations are pervasive across all NSERC programs. NSERC ensures that policies, rules and criteria do not create barriers to international collaborations. However these collaborations must be within the NSERC;s Mandate.

NSERC promotes the internationalization of research and training through scholarships and fellowships, direct research costs related to international exchanges and collaborations within academic and/or industrial partners.

Decision process

Question: Who can submit new ideas on infrastructures?
The main priorities come from the roadmap, then the applicants can propose some new ideas. (? Unclear?)

Applications

- *Discovery Grants program http://www.nserc-crsng.gc.ca/Professors-Professeurs/Grants-Subs/DGIGP-PSIGP_eng.asp*
  35 000 applications per year, average grant is $34 K, with a range of $13 K to $200 K per year. The success rate was 60% in 2009. About 80% of the applications are renewal grants. The number of renewals is not limited. It is a career-based program, to sustain long term objectives of basic research (5 year grant). 30% of these applications are in Life Sciences, for biological systems and functions. There is also the "Discovery Accelerator Supplements Program" ($120 K for 3 years) to accelerate progress of outstanding research programs. Mainly used for access to or acquisition of highly specialized equipment.
- *Major Resources Support program*

http://www.nserc-crsng.gc.ca/Professors-Professeurs/RTII-OIRI/MRS-ARM_eng.asp

Support for researcher's access to major international/national facilities. It provides operating and maintenance funds. It covers cost for:

- salaries of technical and professional research support employed to operate and maintain the resource,
- operations and maintenance cost of the resource,
- materials and supplies and minor equipment essential to the operation and maintenance of the resource
- travel expenses to attend conferences in order to keep up with scientific and technical advances
- dissemination cost, as part of outreach activities
- operation of scientific review panels and governing bodies

Ineligible costs are overhead cost

The selection criteria are:

- Uniqueness of the resource
- The use of the resource by the research community
- The need for access to the resource for the research programs
- Merit of the research program
- Demonstrated need for support through an MRS grant
- Management of the resource
- Contribution of the resource to the training of highly qualified personnel
- Synergy

It also finances the 3rd generation synchrotron in Saskatoon. There are no budget thresholds, it is intended for national access to facilities.

Review process

- *Discovery Grants program*: International review panel.
- *Major Resources Support program*: national review panel
- *Networks of Centres of Excellence* (NCE): international peer review panel with a 2-stage process: a multidisciplinary committee and then expert panel reports. The final selection committee is 1/3 Canadian only.

Decision process

- *Discovery Grants program*: selection is by Evaluation Groups defined on research topics.
- *Major Resources Support program*: Letters of intent are selected by the NSERC internal committee; selected PI's can submit the full proposals, which are examined by a grant selection committee of experts. This committee makes the final recommendation to NSERC on all the proposals.

Monitoring/ evaluation
Networks of Centres of Excellence (NCE) have annual progress reports submitted for review.
For the other projects, it is mainly on-site mid-term reviews.
The time required for the process is about 6 months

Recent trends and challenges

Challenges for the funding of high level life sciences facilities
Canada has a rich and complex system of funding Science and Technology and has a vision for national operations. Canada is a large country, therefore it creates virtual centres of excellence, which implies a cultural change.

The main issues facing Canadian research infrastructures are sustainability, funding of operating costs, finding and keeping skilled technicians, upgrading of the equipment and who will be in charge of these tasks (government, universities or industrials)
A new Networks of Centres of Excellence (NCE) in 2009 has been initiated. It can fund everything for 3-4 networks with 1/3 in life sciences. Networks will be funded for up to 5 years.

Like for most of the Canadian organisations, the main change occurred in the Canadian funding scene is the institution of the Canadian Foundation for Innovation (CFI), which finances research infrastructure in all the fields.

Regional centres vs. national centres
NSERC has headquarters in Ottawa and 5 small (4 employees) regional offices in the Atlantic, Ontario, Québec, Prairies and Pacific regions.

(National) roadmap for bioanalytical RIs
Health and related life sciences and technologies are the third priority area in Canada R&D Priorities .

Staffing
Specific grants are aimed at facilitating the hiring of high-level trained staff. As for the younger researchers, there are dedicated scholarships and grants for them too.

Co-operation with European/international programmes
NSERC is a partner of a European INCO program and wishes to be more involved into international projects. ?

NSERC has a passive approach to international cooperation. For large networks, it provided money ($200 K) for a pilot program to link the involved partners (exchange, transfers of personnel…)
The main point is to provide the backbone for the cooperation. In the Discovery Programs, there is no dedicated money for international cooperation yet funds can be used to collaborate with colleagues abroad in a variety of ways, from fieldwork and research conferences to collaborative trips and stipends for students and visiting researchers. However, only the direct costs related to international exchanges and collaborations are eligible expenses, fund can be used for a variety of international activities, from ; 50% of the researchers have such collaborations.

In NSERC Strategic Partnership Programs, funds can be used in variety of ways, including leveraging research funding on projects with colleagues abroad..

For example, NSERC and France's Agence National de la Recherche (ANR) maintain a concurrent call for joint research projects through NSERC Strategic Project Grants Program. Six joint projects where awarded funding in 2009.

Intellectual property rights
NSERC does not claim ownership of the intellectual property of the researchers it funds. A Steering committee decides on the management of IPR. NSERC respects the academic requirement, has the obligation to identify patents and has a preference to benefit to Canada.

Contrary to NRC, NSERC is not in favour of a strong support for licensing. NSERC is of the opinion that the cost needed to establish a licensing office with enough expertise are too high in order to be beneficial. Instead NSERC supports cooperation and partnerships. It has established technology transfer officers who bring together people from academics and industry or government.

NSERC Policy on Intellectual Property

http://www.nserc-crsng.gc.ca/NSERC-CRSNG/Policies-Politiques/ip-pi_eng.asp

5.5 Genome Canada (GC)

Ottawa

Website: http://www.genomecanada.ca/

Participants:
- Dr. Cindy Bell, Executive Vice President, Corporate Development
- Dr. Karl Tibelius, VP Genomics Programs

Report by: Thomas Gübitz

Basic facts

Short characterisation
Genome Canada (GC) is a not-for-profit Corporation focussing on the disciplines Genomics/Proteomics in the areas: Agriculture, Environment, Fisheries, Forestry, Health, New Technology, GE3LS (Genomics and its Ethical, Economic, Environmental, Legal and Social aspects).
The stage of research funded is discovery research. The project types are large scale, curiosity driven and targeted projects. Genome Canada is involved in international initiatives, science and technology (S&T) Platforms – providing access to cutting edge infrastructure and technologies. Funding is provided via contracts with co-funding of up to 50%. The recipients of funding are researchers (not only GC researchers) in genomics, proteomics, and GE3LS.

Organisational structure of GC
According to the main web site of Genome Canada (http://www.genomecanada.ca/) the organisational structure of Genome Canada is as follows:
Genome Canada's Board of Directors is comprised of up to 16 individuals, drawn from the academic, private and public sector communities. The presidents of five major federal research agencies —the Canadian Institutes of Health Research, the Canada Foundation for Innovation, the National Research Council Canada, the Natural Sciences and Engineering Research Council of Canada, and the Social Sciences and Humanities Research Council of Canada — are ex officio advisors to the Board of Directors.
The Board has established a number of committees to help it discharge its duties, including an Executive Committee, Audit Committee, Investment Committee, Election Committee, Corporate Governance Committee and Compensation Committee.
The Board of Directors has also established a Science and Industry Advisory Committee that provides strategic and visionary advice and expertise on an integrated strategy for research and development in the areas of genomics and proteomics in Canada.
On an annual basis, the Board of Directors evaluates its effectiveness in fulfilling its roles and responsibilities. The process assists the Board of Directors in determining what is working well, and identifying areas for improvement. The evaluation tool is a comprehensive questionnaire that is self-administered. The process is overseen by the Corporate Governance Committee.
Genome Canada has established a *list of policies* on the following areas:
- Access to Research Publications
- Candidates at a Federal Election
- Communications: Recognizing Genome Canada and Genome Centres
- Communications: Reporting to Canadians on the Progress of our Research
- Data Release and Resource Sharing
- Emerging Issues
- Intellectual Property
- Investment
- Membership
- Privacy Policy – Corporate
- Risk Management
- Science and Technology Platforms Access
- Succession Plan
- Travel

- Use of Unspent or Savings Related to Approved Research Projects
- Vacation and Leave
- Whistle blowing

Genome Canada also provides *public accountability statements*:

- Performance Audit and Evaluation Strategy
- Risk Management Policy
- Recipient Audit Framework
- Interim Evaluation
- Five-Year Evaluation
- Bibliometrics Review
- Performance Audit
- Reviews Done by Others

To ensure effective management and monitoring of Genome Canada funded projects and science and technology (S&T) platforms, Genome Centres have been established in each region across Canada. These Centres facilitate access to leading edge technology for researchers, allow for different approaches to project development and fundraising, and provide opportunities for public outreach programs at a regional level.
Each Centre is established as a not-for-profit organization. A contractual agreement with Genome Canada outlines specific terms and conditions for the funding of large-scale research projects and science and technology platforms in genomics and proteomics. The following Genome Centres are established in the provinces:

- Genome British Columbia
- Genome Alberta
- Genome Prairie
- Ontario Genomics Institute
- Genome Québec
- Genome Atlantic

Funding schemes provided & decision process

Funding of Genome Canada
GC receives its funds from the federal budget, starting in year 2000 with $160 million. Annual funding is depended on the annual federal budget surplus and ranges from $60 million to $165 million per annum with no funds received in the years 2002 and 2006.

GC projects
GC projects are funded to 44% by GC, 19% from provincial and 19% from foreign, 8% industrial, 6% federal and 4% institutional sources.

The scientific portfolio (2000-2009) of the GC centres cover agriculture, environment, fisheries, forestry, GE3LS, heath, technology development; with almost all sectors represented in all regional GC projects and health projects making up 25-50% of the regional GC projects. In each region there was/is at least one GC platform, with Ontario hosting two and British Columbia hosting even 4 GC platforms.

The projects are milestone-driven and comprise discovery and translational research, with the latter being expected to expand in the future. The projects are funded with in average $15-20 million over five years and provide also access to non- GC funded scientists. GC funds up to 50% of project costs.

Projects are selected according to quality and have to fulfill the objective of accessibility.

S&T Platforms
S&T Platforms provide services and training.
Currently there are six platforms with over 1,000 other users (for more details about platforms see appendix). The platforms provide all relevant genomics/proteomics services as well as training. There are significant reductions in costs due to economies of scale. Platforms are also innovation centres providing access to new knowledge and expertise. With the exception of the Operations

support portion, platforms are co-funded by Genome Canada and others. Each platform has a public web site to promote awareness of the services offered and provide access.
Genome Canada funds 100% of operations support for the platforms. Some costs of services are recovered from users, including GC-funded projects who request funds for platform services in project budgets (of which GC funds ~ 50 %). Separate competitions are run to finance the development of new technology. A new platform model would see some funds available to platforms for this activity within the platform as well as ongoing competitions.

Platforms are selected by competition. Prerequisite conditions are: the demand from Genome Canada-funded projects for the platform and at least 20% additional capacity is reserved for other users. The platforms function is providing service and training. Scale is important for being/becoming a platform. Operation/support is funded 100% by GC, service by 50%, upgrade and development is funded via ad-hoc requests, technical development is funded via a separate competition.
Platforms receive continuous monitoring and periodic review: that is all platforms are required to have a Scientific Advisory Board (SAB); Chuck Hasel, Technology Development Consultant for Genome Canada, is responsible for Platform oversight. He sits on each of the SABs. A yearly national Platform Leaders Meeting is held to ensure good communication and sharing of best practices.
The platform activities and investments are coordinated with CFI (Canadian Foundation for Innovation).

Evaluation and management of centres
Centres are evaluated by all funders. Financial reporting is required every 4 months, major scientific reports at least twice a year, major mile stones checked every 1,5 years. The mile stone review may lead to major redirection or cuts. A full time project manager is required for every project.
Reviewers are paid and kept for interim review allowing some permanence. Reviewers meet applicants. Due diligence review: financial and scientific reviewers examine project management locally before the scientific review takes place.
The centres should become self-sustaining in the long run.

Recent trends and challenges

Commercialisation
Commercialisation has been recognised as a gap. There is now a strong push toward commercialisation. Hence there is more focus on establishing start-up companies and private public partnerships. The Department of Industry gives money to GC for this purpose.

Technology development
Funding for technology development was limited ranging from $0.5 to 2 million over 2-3 years. These funds are accessible to non- GC groups, but results have to be accessible to GC. There are no tie-ups of IP. Projects are open to industry collaborations. (see Guidelines http://www.genomecanada.ca/medias/PDF/EN/guidelines_genomics_research.pdf)

Future considerations
Coordination with important platform co-funders (notably the Canada Foundation for Innovation which funds much of the equipment and infrastructure needs of the platforms) would increase the efficiency of the platforms and reduce the burden on researchers.
Providing some funding within each platform budget for technology development would allow the Platforms to improve methods and procedures and develop better analysis software.

Appendix
Current GC platforms:
The current six S&T platforms are:

UVIC-GENOME BC PROTEOMICS CENTRE
Christoph Borchers, Victoria, British Columbia
•BioMarker Discovery and Validation
•LC-MS/MS, MALDI-TOF PMF, LC-MALDI-MS/MS, Nanospray, MRM

•**Complex Protein Identification**
•Multidimensional LC-MS/MS, Liquid Chromatography MALDI, Free Flow Electrophoresis
•**Differential Protein Expression Analysis**
•ITRAQ, SILAC
•**Protein Characterization**
•Post-translational modification identification, top-down and bottom-up proteomics
•**Peptide Synthesis**
•Isotopically coded and non-coded peptides
•**Metabolomics**

GENOME SCIENCES CENTRE
Marco Marra, Steve Jones, Rob Holt, Vancouver, British Columbia
•**Bioinformatics**
•Expertise in expression profiling, gene regulation, comparative genomic analysis, genome assembly, BAC fingerprint physical map construction and LIMS
•**Sequencing**
•Sanger
•NexGen (Illumina/Solexa)
•Gene Expression, ChIP, microRNA profiling, WGSS
•**Physical Mapping**
•BAC fingerprint physical maps

THE MICROARRAY FACILITY
Colleen Nelson, Colin Collins, Vancouver, British Columbia
In-House Printing
Operon mammalian whole genome oligo libraries
Invitrogen and Ambion miRNA mammalian oligo sets
Custom cDNA, oligo and protein sets for expression and SNP microarrays
Agilent Certified Service Provider
CGH, expression and custom multiplex high-density microarrays
Roche NimbleGen
CGH, expression, CHIP, Met and custom multiplex high-density microarrays
Microarray development and sample processing
Data Analysis
Custom Services

GENOME CANADA BIOINFORMATICS PLATFORM Christoph Sensen, Calgary, Alberta
Large Scale Genome Analysis and Hardware Provision
Sequence Analysis & Annotation, Microarray analysis, Comparative genomics, Analysis automation, Database search engines, data storage, access to software tools and databases
Help Desk/Tools
Call 780-492-5969
BioMOBY/Web Services
Access bioinformatics tools and services worldwide automatically

THE CENTRE FOR APPLIED GENOMICS
Steve Scherer, Toronto, Ontario
Sequencing
Sanger and NexGen (Illumina/Solexa, Roche/454, ABI SOLID)
High-performance computing and bioinformatics support for analysis and assembly
Genotyping
Illumina genome wide (Infinium) and custom content (iSelect and GoldenGate), Capillary-based (Taqman, SNaPshot, microsatellites), Custom (heteroduplex analysis), Mouse (for cross progeny analysis)
Microarrays
Affymetrix, genome wide SNP/CNV arrays, gene expression, filing, promoter and exon arrays; Agilent oligonucleode arrays; Illumina – SNP, methylation, microRNA, gene expression, etc.
Statistical and Bioinformatics Services
Project consultation and power analysis, statistical analysis (genetic, microarray and pathway data, epidemiology, population genetics), Copy number variation
Cytogenomics

Karyotyping and SKY, FISH mapping, G-to-FISH
Oligonucleotides
Biobanking
Genome Resources

THE MCGILL UNIVERSITY AND GENOME QUEBEC INNOVATION CENTRE
Ken Dewar, Montreal, Quebec
Genotyping
Microsatellite, FP-SBE SNP, Sequenome iPLex SNP, Illumina and Affymetrix SNP
Sequencing
Sanger and NexGen (Roche/454)
Proteomics
Sample preparation, 1D and 2D analysis, MS analyses, Mascot services, analysis and comparison to proteomics data sets, quantisation, LC-Qtof micro, LC-4000 Q Trap, MALDI-Qtof Ultima
Functional Genomics
Bioinformatics

5.6 NRC Biotechnology Research Institute (NRC-BRI)

Montreal

Website: http://www.nrc-cnrc.gc.ca/eng/ibp/bri.html

Participants:
- Dr. Andrew Storer, Director of Health Sector
- Dr. Charles Greer, Environment Sector, Environmental Microbiology Group
- Dr. Jalal Al-Hawari, Environmental and Analytical Chemistry Group
- Dr. Denis Bourbeau, Research Coordination Office
- Dr. Mirek Cygler, Macromolecular Structure Group
- Dr. John Luong, Biosensors and Nanobiotechnology Group
- Dr. Feng Ni, Biomolecular NMR and Protein Research Group
- Dr. Malcolm Whiteway, Genetics Group

Report by: Stefania Usai

Basic facts

The NRC Biotechnology Research Institute consists of three research divisions, namely the Environment Sector, the Health Sector and the Bioprocessing Centre.
The focus of BRI is on research as well as the related technology transfer to industry in the fields of Health and Environment. To this end, besides conducting its own research, BRI offers expertise and services through cooperation with industry, and also by renting laboratory space and equipment to third parties at the BRI Industrial Partnership Facility.

Health Sector
This is the largest division. In the Health Sector, research focuses on two main themes:
- Lead compounds
- Enabling technologies for biotherapy

The projects expand from exploratory phase to development phase, the later projects being more oriented towards assessment of transferability to industrial production.

Environment Sector
Activities in this division focus mainly on:
- Environmental protection, from surveillance of ecosystems to detection and decontamination
- Eco-efficient industrial production, from design of biomass conversion to bio-energy to the assessment of the ecological impact of production processes and products.

Bioprocessing Centre
Comprises among others a large fermentation facility, an animal cell pilot plant and a microscopy imaging facility.

There is much cooperation between the section Health and the Bioprocess centre on the protein production. There is also interaction between Health and Environment on the access of some infrastructure, such as the array platform and the NMR.

Funding

BRI receives a significant part of funding from collaborations with industry and SMEs and offers space and lab infrastructure to companies to come and work. This creates actually some tension for scientists, about how much time to dedicate to own research versus time dedicated to assist hosted companies at the BRI facilities.
The funding to BRI from NRC amounts to $15 million. Additional funding from NRC comes from BRI scientists participating in multi-institute 'Horizontal Programs'. Also through cross-appointments with local university departments BRI scientists can apply for funding to the Canadian granting councils. The distribution of the funds per activities varies for each of the three sectors, as they have different focus.

Investments for upgrade of RI
NRC has a yearly internal competition for instrumentation, not for repairing and maintenance of existing equipment but for upgrading in terms of new components. Usually this competition is used for larger funds, starting from $1 million, for example for the upgrade of the NMR. For smaller amounts the funding comes from internal resources of the institute.

Recent trends and challenges

Research Infrastructure
NRC is traditionally focused on RI and until 10 years ago NRC was running and funding major facilities in Canada. These facilities are now becoming obsolete and the upgrade and renewal of infrastructure is therefore a major issue for NRC. Institutes cannot renew themselves because they cannot apply to CFI, so they have to apply to internal NRC competitions.
The institute has used until now allocation of funds to groups to maintain their own infrastructure. It is however shifting towards a mix of this with funding allocated to projects: in this latter approach the funds are allocated to groups based on their participation in the projects.
An advantage of the organization is that it can charge overhead costs to the external users, and since NRC does not reclaim these overhead costs, they can retain them and they are therefore an additional source of revenues from RI.
Also, facilities that are running obsolete in one application field can be switched to another application for which they are still cutting edge. In the case of the micro array facility for example the technical capacity is actually superseded by the current technology in certain fields, but it is still cutting edge in others like protein printing.

Staffing
Another advantage of the organization is that it supports highly trained technicians, which allows going on even if the equipment is getting obsolete. On the other side universities get cutting edge equipment funding (which was in the past a prerogative of NRC) but few staff.

IP activities
BRI has IP Generation Programs, i.e. internal programs to generate Intellectual Property. Earlier the purpose was to sell to industry, however the products turned out to be in general “too new” for industry; nowadays there is more focus on the development to facilitate the technology transfer to industry.

Closing down projects and opening new ones
The institute is not as flexible in this as universities are, because it has to keep into account the high expertise of its personnel. The projects are reviewed by externals, also from the industry, whose advice can be used to refocus a project if necessary. Review committee members are mostly Canadian, but there might be also international members.
As for opening new directions, this is not very easy for BRI, which lacks flexibility. In general, it becomes more and more difficult to find funding for new initiatives. However, the institute receives for example funding for a new cross-institute Genomics and Health Initiative (NRC-GHI) Cancer program. This large-scale research program involves the participation of four NRC institutes and brings $1 million/year funding at NRC-BRI for the Health Sector and the Bioprocess Centre. For this new initiative however, the funds are obviously for genomics-oriented projects.

Cooperation between NRC institutions
There are always possibilities for cooperation between NRC institutions, however there is not much exchange of researchers between institutes – the researchers who leave are more likely to go outside the organization.
There are collaborations between institutes for example on genomics, as mentioned above.
Also, there is from NRC a bit more push to collaborate between institutes now than in the past.

The visit was closed by a tour of the institute, with a visit to one facility at each sector:

- Bioprocess sector: fermentation facility
- Health sector: NMR – one 800 MHz and two 500 MHz- NMR
- Environment sector: High Throughput Sequencing Facility.

5.7 McGill University and Génome Québec Innovation Centre

Montreal

Website: http://www.genomequebecplatforms.com/mcgill/home/index.aspx

Participants:
- Dr. Ken Dewar, Acting Scientific Director
- Daniel C. Tessier M.Sc.A., Senior Director, Operations and Business Development,

Report by: Michael Ball

Basic facts

The McGill University and Génome Québec Innovation Centre is a major project funded largely by the Canadian Government through Genome Canada and situated at McGill University in Montréal. Genome Canada itself supports a total of 6 platforms across four Canadian provinces, with financial support also coming from the provincial governments. Génome Québec currently operates five Technology Centres, including this one. Génome Québec was founded in 2000 and has distributed in excess of $420 million in funding since that date to more than forty projects, with $30 million from funding being secured last year. The Innovation Centre itself comprises approximately 10 McGill PIs and their research teams and a full service component comprised of Génome Québec employees (technical staff, client managers and bioinformaticiens). The Innovation Centre is a major site for collaborative projects and has taken part in research of international renown, for example the International HapMap project (http://hapmap.ncbi.nlm.nih.gov/). In 2008, the Centre made an early strategic decision to invest in Roche 454 Next-Gen sequencers but has since also introduced the Illumina technology in support of its research community.

Funding

Much of the Innovation Centre funding comes through Genome Canada, with further funding through the Québec province, mainly via the office of the Minister for Economic Development. Infrastructure funding comes through the Canada Foundation for Innovation. As with all infrastructure funding from this source, a project application must be made. The amortisation of the equipment and salaries are not supported through CFI, instead salaries for support staff are supported through Genome Canada.

Recent trends and challenges

A number of challenges facing the Innovation Centre focus around the different sources of funding used. Funding from the three research councils is not considered as suitable for funding large-scale projects, and funding from Genome Canada is difficult for major (4-year) projects. Both GC and CFI funding only cover a portion of the costs, and while provincial funding can usually be secured to cover the remainder of the required funding for CFI applications, it can prove to be difficult to secure other funding for Genome Canada projects. Further there can be a lack of continuity of funding from Genome Canada. As GC does not have a line in the official budget, funding can be cut drastically or not awarded. Further, directed rather than open calls can be issued where projects are to be applied towards particular areas. This can cause problems if, for example, a PhD student has been working on a particular area then has to switch his/her focus to the area designated under the directed call. Funding under CFI was perceived to be risk-averse and funding of novel technologies was thought to be difficult. This was considered as a consequence of the management plans that were required as part of a project submission. Expertise had to be demonstrated along with a significant user community and a number of projects that were waiting to use the system. All these are difficult to demonstrate for the newest, cutting edge technology. For massively parallel sequencing, problems were identified around the pure cost of single runs using the Roche 454 equipment. This is a considerable barrier to obtaining the pilot data necessary to projects and also means that operators of the technology can be reluctant to train new users or students on placement due to the huge potential financial cost if something does go wrong. There can also be some issues around career progression for

scientists. The senior scientific staff employed by the Innovation Centre is those that have not been attracted to an academic career, but there remains a ceiling on their career progression i.e. at platform manager level.

The Centre itself is not large enough to collaborate directly with instrument developers, instead they collaborate with some centres in the US who do collaborate with manufacturers, and use this interaction as a mechanism of accessing new technologies indirectly. It can take around a year between identifying equipment and bringing it to the laboratories. A contingency fund is in place to purchase small items of equipment. Facility access is open to any users, with 24% of the clients from out-of-province, non-Canadian or non-academic. The facility operates on a cost recovery basis, with overseas academics and industrial clients being charged higher fees, the profits from which are redeployed back into infrastructure investment. Since 2007, the Innovation Centre has obtained official certifications from Illumina (CSPro GoldenGate, Infinium and Expression) and is currently the only centre in the world to have a Centre of Excellence for Genotyping status for the Sequenom technology. There has been a key shift in operation from a “fee-for-data” to a “fee-for-service” model. This is because in many areas, the clients are not interested in large amounts of data but rather in what information the data will give them. This is partly as a result in the increase in the amount of data generated by NGS technologies. In practice therefore, the Centre can incorporate considerable bioinformatics effort as part of their service. The Innovation Centre has developed a web secure application (Nanuq) for the exchange of data. The proteomics laboratory that operates from the Centre also acts as an integrated service.

International collaborations exist, for example an NIH grant has been secured with collaborations. Genome Canada encourages co-funding of projects.

5.8 Structural Genomic Consortium (SGC)

MaRS Centre, Toronto

Website: http://www.sgc.utoronto.ca/sgc-webpages/sgc-toronto.php
http://www.thesgc.org/

Participants:
- Prof. Cheryl Arrowsmith PhD, Director SGC Toronto
- Dr. Raymond Hui, Scientist SGC Toronto

Report by: Benoit Dardelet

Basic facts

The Structural Genomics Consortium (SGC) is a not-for-profit organization that aims at determining the three dimensional structures of proteins of medical relevance, and to make them available on an Open Access basis in the Protein Data Bank. The SGC operates out of the Universities of Oxford and Toronto and Karolinska Institutet, Stockholm. The SGC is divided into 3 main sites (Oxford with about 70 staff, Toronto with 90 and Stockholm with 30). The SGC is home to approximately 180 scientists and other support staff (as of 2009).

The SGC is a public-private partnership, with stakeholders from Canada and the rest of the world. The funders are from Canada (CIHR, CFI, GC), Ontario, Sweden (Knut and Alice Wallenberg Foundation), Wellcome Trust, GSK, Merck, Novartis. The budget amounts to $30 million per year. The proteins are nominated by the funders to the SGC Target List, comprising ~2400 proteins. Targets are selected with therapeutic view. No funder has access to progress of SGC Targets through pipeline.
SGC's objectives are to have 386 structures of proteins from Target List by July 2007 (achieved 455) and an additional 660 more structures by July 2011 (including 8 integral membrane proteins).

Since 2007, the impact of SGC on drug discovery has been recognized. The trend is identical for the Protein Data Bank where SGC is presented as the main provider (before RIKEN) of new structures of human proteins. The most recent project in which SGC is involved is The Human Kinome. With this project kinase targeted structural genomics has significantly increased during the last past 4 years the number of novel protein structures, and has surpassed published industrial efforts last year. It is now a world leading project.

Management structure
A Board of Directors and a Scientific Committee, both nominated by the funders, supervise the activities. They meet quarterly, in person, with the SGC director and the heads of the three sites to review progress.. The Scientific Committee must approve all protein target that are worked on.

Relevance with respect to national/ international context
The SGC is a Canadian public-private partnership with a mandate to place protein structures of relevance to human health into the public domain, free from restrictions on use. The focus is on proteins from human and human parasites. The aim is to promote drug discovery by substantially increasing the number of medically relevant protein structures, as well as related reagents and protocols, available in the public domain, especially human proteins (main effort) and Proteins from pathogens (e.g. Plasmodium, Leishmainia).
The SGC is highly committed to rapid dissemination of its research results through collaboration with the scientific community.

Funding

SGC funds equipment for the Canadian lab,mainly with CFI funds and matching provincial (Ontario) funds. Operations and salaries are funded through CIHR, Genome Canada, and the Ontario provincial government, supplement by some funds from the Pharmaceutical partners. Funding is application-based, primarily through "strategic opportunities" mechanisms at the various granting agencies.,.

In addition, the SGC has a visiting scientist program, in which the collaborating lab unit pays for salary and travel of its own personnel, while SGC supports laboratory costs and supplies of the visiting scientist. SGC pays for its own personnel.

Recent trends/challenges for life science facilities

A recent development from the point of view of funding is the rise of new actors such as the Canadian Foundation for Innovation.
With respect to developments in SGC itself, a new trend is to hire “Collaborations Managers”, highly specialised staff who take care of the administrative part of the project.

The SGC has launched a recent initiative to develop “chemical probes” (potent, selective and cell permeable compounds) that can be freely used as research tools by the research community, including industry. This is done in partnership with medicinal chemists at pharmaceutical companies who agree not to restrict the use of chemical probes. This is a novel paradigm that pushes the boundary between precompetitive and competitive biomedical research.

Staffing
By being such a research centre, SGC can afford to pay competitive salary. Also, the personnel are recruited both at the local and the international level. And finally, if necessary the current staff is trained; cross training between the 3 sites is used.

Development of new technologies
In house development is combined with buying the latest available technologies.
The sites, which involve various communities from bioinformatics, biotechnology and biochemistry, use the latest possible technologies, in order to optimize the workflow and its organisation, the Toronto site being targeted mainly on crystallisation and X-Ray diffraction.
SGC intends to challenge the technologies by stretch goals, with the motto that necessity will drive innovation.

Access to the facilities
The first priority is for internal access in order to achieve the research goals of SGC. In case of excess capacity, access is granted to local labs and visiting scientists on a collaborative basis.

Co-operation with other institutes
The main collaborations are with the local institutions, then collaborations with more than 40 Academic Institutions in Canada.

Co-operation with European/international programmes?
Cooperation is achieved through the Visiting Scientists Program and through numerous strategic and specific collaborations.
Visiting Scientist program
In this program, the collaborating lab pays for salary and travel of its personnel, while SGC supports laboratory costs and supplies. The exchange is based on common and aligned objectives.
Scientists can spend time in SGC (Toronto, Oxford or Karolinska) working on projects of mutual interest. The following conditions apply:

- the visiting scientist retains the “ownership” of the project, with as objective a collaborative publication
- the duration ranges from a minimum of 3 months up to one year
- the visitor is responsible for salary and living expenses
- structures must be released immediately and all data must be published (if suitable)
- SGC is responsible for operational costs

Strategic and Specific Collaborations
Ongoing main collaborations are with Synchrotrons, with the NIH Chemical Genomics Screening Centre, the European Bioinformatics Institutes and the Drug Discovery in Dundee.

Intellectual property rights
All structures/results are promptly made freely available (not even funding partners get prior access or rights to data or progress information)..The SGC focuses on “precompetitive” science of relevance to the pharmaceutical industry. The goal is for SGC scientists to make their research

output (materials and knowledge), including that of collaborative research, available without restriction on use, so that both academia and Industry are free to do any experiments with the results. Neither SGC scientists nor the SGC will agree to file for patent protection on their research output. The SGC encourages those using SGC research output to avoid placing restrictions on the use of their science.
The open access initiative must achieve freedom of use (to conduct experiments and publish results), at the same time protecting IP by 1) retain right to file protective patent on the chemical probe 2) putting a 6 month hold on release of the chemical structure and 3) a commitment not to commercialize the probe compound.
Individuals (especially participants through the Visiting Scientist program) are required to sign a confidentiality agreement.

Interaction with companies/industry
SGC aims at promoting scientific discovery to industry, mainly through its funders from the industry (GSK, Novartis, Merck). The funders have no IPR or prior access to SGC data (but they are able to nominate targets and influence strategic directions at Board level). For new partners and initiatives, there is Open Access to Chemical Probe (GSK & others pending), and also an Open Access to Antibodies and capture reagents (Invitrogen).

The second kind of interaction with companies is for the Dissemination of Reagents and Technology. To this end SGC uses partners such as Harbinger Biotech (spin-off instrumentation Co), Open Biosystems (market SGC expression clones), Sigma Aldrich (market chemical probes) or Invitrogen (market Antibodies/protein capture reagents).

Strategy for large scale external public-private collaborations
SGC wants to engage itself with the biomedical community to characterize selective, potent and cell permeable compounds to link biology with inhibition of an individual target or group of targets. Collaboration in structural biology is employed to understand biochemical mechanisms, assess potential binding pockets (drug ability) and to guide medicinal chemistry and selectivity.
The second area of collaboration is in the use of recombinant proteins to facilitate small molecule screening, medicinal chemistry, antigens for generation of recombinant antibodies/capture reagents. SGC also provides an expertise for production of recombinant antibodies.

In conclusion pre-competitive chemistry can be seen as a 3-stage process for SGC. The first stage is a public/private partnership on the chemical probes, for screening chemistry and structure bioavailability. The second phase is the target validation, which belongs to the public domain (no IPR, no restriction on publication). Finally the third phase, the drug discovery, which involves (re)screening chemistry, lead optimization and other developments, is developed by the industry.

5.9 Ontario Institute for Cancer Research (OICR)

MaRS Centre, Toronto

Website: http://www.oicr.on.ca/

Participants:
Dr Thomas J. Hudson, President and Scientific Director

Report by: Thomas Gübitz

Basic facts

The Ontario Institute for Cancer Research (OICR) is a centre of excellence in cancer research with a focus on prevention, early detection, diagnosis and treatment of cancer.
The Institute is an independent, not-for-profit corporation funded by the Government of Ontario through the Ministry of Research and Innovation.
The Institute is bringing together multi-disciplinary, multi-institutional collaborations, which will allow complex questions to be pursued. It is translating research findings into programs, technologies and therapies.
Established in December, 2005, the Institute supports more than 50 internationally recognized principal investigators; there is a strong core of scientists at the MaRS Centre with the remainder in nodes of excellence around the province. Dr Thomas J. Hudson, President and Scientific Director of OICR, was previously Scientific Director of Genome Quebec in Montreal.
The Institute is leveraging the current research excellence at universities, research hospitals and health research institutes across Ontario, leading to greater integration of cancer research efforts across institutions.
The Ontario Cancer Research Network (OCRN), established in 2002, has been incorporated into the Institute. Its initiatives continue under the umbrella of the Institute and include:

- Cancer Research Fund
- Clinical Trials Infrastructure Fund
- Clinical Trials Network
- OntarioCancerTrials.ca
- Ontario Cancer Research Ethics Board
- Ontario Tumour Bank

History of OICR
- 2001 Province created the Ontario Cancer Research Network (OCRN)
- 2005 Province asked OCRN to evolve into a new institute, OICR
- Fall 2005 First Scientific Advisory Board appointed
- June 2006 Thomas J. Hudson appointed first President & Scientific Director
- Feb 2007 Strategic Plan approved by Board
- Mar 2007 Started implementing the Strategic Plan
- Funding from Ontario: $346.5 million over first 5 years – annual funding ranges from $40-80 million

Objectives of the OICR Strategy
- Build innovative, multidisciplinary programs that will impact cancer in the Ontario population (reduce incidence, morbidity and mortality)
- Ensure effective translation into health care products and services
- Build on existing strengths, and fill gaps where necessary to enhance programs
- Establish partnerships (in Ontario, Canada and internationally)

Recent trends and challenges

Technology and IT issues
Technology development (technology platforms in relation to cancer) is a main objective of OICR. Spin-offs are mainly in the fields of imaging (including PETand MRI), and high-throughput methods that can be used in basic research as well as for clinical diagnosis with institute leaders

having generated 15 spin-off companies. Technological developments lie in the area of developing molecular markers (probes and labels) as well as in instrument development.

Sequencing facilities at OICR/MaRS are ranking as the fourth largest in America. The sequencing facility with 21 flow cells (Solexa and ABI) generates about 800 GB of sequences per month and hosts a 1.2 PB of storage in 1600 cores. There is a reserve of about $2 million which can be invested in the emerging next generation of sequencing machines. The reputation of the centre allows the centre to have early access to new technologies. More limiting than the cost for purchasing new systems are the requirements in regard to IT-infrastructure. The data storage and processing demands of the current and next generation of sequencers are described as major implementation hurdles in setting up state-of-the-art sequencing facilities. Hosting the computing unit in an existing building poses large logistical problems, in particular in regard to back-up for electricity and cooling. The obvious solution of transferring data storage off-site requires careful planning and the implementation of the most advanced data transfer technologies currently available. The OICR scientists recommend to create a central facility for similar sequencing facilities on other campuses, since the cost for setting-up the infrastructure for an isolated machine can easily exceed its purchase price of the sequencer by more than 3-fold. Original data should be not be stored but should be processed and analysed immediately and permanent storage should be reserved to the resulting raw sequence files.

In terms of projects the centre can choose which projects to serve.

OICR has a data coordination centre organising data validation and QC. Data is released to public repositories. A strong emphasis is made on prepublication data release (see Nature Vol 461, pp169-170).

International collaboration

OICR is a member of the International Cancer Genome Consortium (ICGC). ICGC's goal is to obtain a comprehensive description of genomic, transcriptomic and epigenomic changes in 50 different tumor types and/or subtypes which are of clinical and societal importance across the globe. ICGC can be described as a large academic biotech enterprise ICGC has funding security over an initial period of four years.

Commercialisation

Killing tumors is one of the main projects of OICR funded with $ 6 M per year involving various techniques such as shRNA, siRNA and innovative approaches in the field of Medical Chemistry. Commercialisation plays a large part (including a deal with Pfizer over $ 6 M). The area of Medical Chemistry was identified as a critical platform for the advancement of the translation mission of OICR and recommended by OICR scientific advisory board in 2007. The Chemistry laboratory with 21 hoods on the 8th floor of the South tower was identified as suitable space and subsequently transformed into an area for platform development and building. A platform director joined OICR in July 2008. The medicinal chemistry team that was recruited has an academic, biotech and big pharma mix of industry experience. A nanotechnology PI started in June 2009. The next focus will be on the definition of biological questions and establishment of the appropriate functional assays and efficient screening protocols.

- Completed equipping of lab with state of the art instruments
- Purchased 140,000 compound library for screening (McMaster)
- Increased visibility within local and provincial community
- Project review of 14 potential opportunities and prioritization
- Initiated projects with local investigators and in discussions with potential international partners

IP Development and Commercialization Program (IPDCP)

- Up to $500,000 over 2 years for each project
  - OICR will collect a share of eventual revenues
- Supports early-stage commercialization activities
  - Proof-of-concept, validation, SOPs, market analyses, IP costs, expert guidance and management
- OICR adds value
  - Sits on the Commercialization Committee guiding each project
  - Provides expert advice and industry contacts

- Program Challenges
  - Educate recipients
  - Manage commercialization committees
  - Generate private investment interest
  - Recruit and retain experienced executives

<u>2007-08: 5 projects selected for the IPDCP</u>

- Novel cellular immunotherapy for leukaemia

University Health Network, Dr. Li Zhang
Clinical data within two years

- 3-D ultrasound-guided biopsy and therapy platform

Robarts Research Institute, Dr. Aaron Fenster
Broad applications

- Colon cancer genetic risk prediction tool

ArcticDx Inc., Mr. Greg Hines
Service within two years

- Real-time MR-guided ultrasound therapy for prostate cancer

Profound Medical Inc., Drs. Michael Bronskill & Rajiv Chopra
Disruptive technology

- Flow cytometer-mass spectrometer for multi-parametric biomarker analysis

DVS Sciences Inc., Dr. Scott Tanner
High-parameter and high-throughput biomarker analysis

A talk by Dr. Vladimir Baranov on the development of the CyTOF mass cytometer instrument provided an example of OICR policy encouraging commercialisation, with OICR successfully translating in-house inventions all the way to the commercialized product.

6 Conclusions

We give hereby a list of our main observations on funding and research in the Life Sciences in Canada, as perceived after the study tour.

Funding

Funding of Life Sciences occurs along different streams, and is mainly assigned on an early basis from the government to the funding agencies. As a result, strategies are usually formulated on a short term basis only (max 5 years) by funding agencies as well as by research institutions. Also, funding is strongly connected to a limited number of strategic priorities set by the government. These strategic priorities are applied in the granting policy of the funding agency to direct the major part of the funds. Conversely, funding for research not explicitly aligned with strategic priorities and for new initiatives is considerably less: for NRC it amounts to 5-15%, while 85-95% is locked to the strategic priorities.

Research funds' distribution is fragmented. As well as a number of funding agencies at the national level (among which the funding organizations we visited), the federal provinces are also entitled to assign research funds. These funds are usually targeted on cooperation with local industry and institutions, and/or on issues of particular relevance to that particular province – think of agriculture, fishery or environment, or specific health issues for the case of the life sciences.

For Research Infrastructure the main funding stream is from the Canada Foundation for Innovation.

Granting procedures

Granting is subject to very strict accountability rules. Both financial and scientific progress reports are due mostly on a 3 to 6-month basis. The overhead costs at the granting institutions are also rather high as a consequence. Much emphasis is also placed on the quality of the management of the granted projects: a number of Canadian funding agencies, among which CFI, has recently published a handbook for governance and management of major initiatives in Science and Technology.

Grants cover in general only a portion of the required budget. The rest of the budget has to be paid by the receiving institution, which has to provide the remainder of funding themselves. The part of the budget brought by the institution is usually significant, for example CFI pays only 40% of the required budget. The institutions usually apply to the provinces for additional funds and seek connections with the local industry through collaborations and/or the provision of services and facilities.

Grants for RI do not usually cover running costs but only acquisition costs. CFI is the only funding agency giving money for running costs, but it assigns only once a sum equal to 30% of the granted funding – that is 12% of the total required budget. The research councils provide a separate fund for overheads to which universities can also apply.

Collaboration with industry

The focus on the application of research for the benefit of the Canadian society is very strong. This and the necessity to seek for additional funds to complement the granted funds constitute a strong incentive for collaboration with industry and companies. Some research institutions, like for example NRC institutes and Genome Quebec, generate a significant part of their revenues from hiring out staff and renting equipment and laboratory space to companies. Other organizations, like SGC and OICR, have even stronger links to industry being very active in developing collaborations with companies for the purpose of research and/or the commercialization of research results. Funding agencies from their side strongly encourage collaboration with industry: Genome Canada for example has instituted the Technology Development Competition to this purpose. Another example is the Strategic Partnership Program of the NSERC.

IP policy

The policy with respect to IPR varies extremely for different institutes. At one end of the spectrum is the NRC, which has its own legal IP department, with specific procedures and rules to define, for a certain project, who is eligible and for what proportion IPRs they are assigned. In the middle are the most institutions and funding agencies, which consider the own overhead costs for handling IPR too high compared with the possible revenues, and therefore are not actively seeking IP. Finally at the extreme end of the spectrum is SGC, who applies and actively propagates an Open Access policy.

Staffing

Acquiring and maintaining highly skilled technicians is a major problem in Canada, according to most of the research institutions visited. NRC institutes especially are clearly focused on training and good contracting conditions to attract and keep personnel in the long term. According to NRC-IBR representatives, the highly specialized staff is the main strengths of their institute. One of the main sources of income at IBR comes from consultancies to other institutions and universities, which may have more expensive equipment but lack technical expertise. In other visited research institutions, such as Genome Quebec, the staff renewal rate is very high due also to the limited career possibilities and many researchers move after to academic positions after time at the institute. This is in contrast with the situation at SGC and OICR: these organizations seem to be very competitive and to have enough funding to attract researchers with good salaries and to buy cutting-edge instrumentation.
Another trend is also to hire dedicated personnel for the project management, especially for the most recent organisation such as GC.

Finally, the “brain drain” to the United States plays of course a large role. To partially counteract this effect, CFI has instituted the Leaders’ Opportunity Fund, an instrument that allows universities to attract top researchers by providing them, with a faster procedure, with the necessary instrumentation and infrastructure to start their activities. The aim of this approach is to make the Canadian universities more competitive with respect to their American counterparts on the research job market.

7 List of acronyms

BBSRC	Biotechnology and Biological Sciences Research Council
CFI	Canada Foundation for Innovation
CIHR	Canadian Institutes of Health Research
CNRS	Centre National de la Recherche Scientifique
DFG	Deutsche Forschungsgemeinschaft
GC	Genome Canada
GSK	GlaxoSmithKline
ICGC	International Cancer Genome Consortium
IPR	Intellectual Property Rights
NGS	Next Generation Sequencing
NIH	US National Institute of Health
NRC	National Research Council
NRC-BRI	NRC Biotechnology Research Institute
NRC-IBS	NRC Institute for Biological Sciences
NSERC	Natural Sciences and Engineering Research Council of Canada
NWO	Netherlands Organization for Scientific Research
OICR	Ontario Institute for Cancer Research
PI	Principal Investigator
RI	Research Infrastructure
SGC	Structural Genomics Consortium

8 Appendix - Study tour programme and participants

ERA-INSTRUMENTS STUDY TOUR

TO

CANADA

September 28 – October 2 2009

Addresses & Phone numbers:

Hotel:	Ottawa	Minto Suites Hotel
	Montreal	Place D'Armes
	Toronto	Sutton Place Hotel

Address Royal Netherlands Embassy Ottawa en Office for Science &Technology:
Philip de Waal
Constitution Square Building
350 Albert Street, Suite 2020
Ottawa, ON K1R 1A4 - CANADA

NOST
Paul op den Brouw
Barbara Staals
Royal Netherlands Embassy
4200 Linnean Avenue NW
Washington, DC 20008
Tel. TWA: +1-202-274.2728

Draft programme

Sunday 27 September – arrival in Ottawa		
Delegation Members: - Dr. Cas Maessen — Netherlands Organization for Scientific Research (NWO), Department of Policy Development and Support" - Dr. Stefania Usai — NWO, Department of Policy Development and Support - Dr. Michael D. Ball — Biotechnology and Biological Sciences Research Council (BBSRC), Engineering, Data and Technologies Sector - Mr. Benoît Dardelet — Chargé de projects Europe-International, CNRS -Institut de Chimie (INC)" - Dr. Thomas Gübitz — Deutsche Forschungsgemeinschaft (DFG), Wissenschaftliche Geräte und Informationstechnik - Mrs. Barbara Staals — Netherlands Office for Science and Technology, Royal Netherlands Embassy, Washington DC - Mr. Philip de Waal — Head Economic Department, Royal Netherlands Embassy, Ottawa, ON		
Check-in	Check-in at Hotel Minto Suites Hotel 185 Lyon Street North Ottawa, Ontario K1R 7Y4 613.232.2200 Fax: 613.232.6962	
19:00	Meeting of partners participants in the lobby of hotel to discuss the visits followed by dinner	
Monday 28 September – Ottawa		
08:30	Gather in Lobby	
08:35	Departure by Embassy van (15 min drive) to NRC at 100 Sussex Drive , Room 2148	
09:00-16:30	**NRC Strategy and Development Branch,** **Participants:** - **Alex Dagger**, Director, Planning and Performance Management, Strategic and Development Branch - **Dr. Bruce Baskerville**, Manager, Strategy Development, Planning and Performance Management, SDB - **Dr. Jean-Robert Brisson**, Director, Institute for Biological Sciences - **Pierre Naud**, Senior Advisor, International Relations Office, SDB - **Dr. Yves Geoffrion**, Business Officer, IBS - **Dr. Jianjun Li,** Research Officer, IBS - **Dr. Harold Jarrell**, Research Officer, IBS - **Dr. Susan Twine**, Research Officer, IBS - **Dr. Jennifer Hill**, Research Officer, IBS	100 Sussex Drive, Rm 2148 Canada K1A 0R6 Ottawa **PoC :** **Pierre Naud, Senior Advisor** Cell: 613-608 5214 **Diane E. Hull**, Office Coordinator Strategy and Development Branch International Relations Office Tel: +1 613 991-5942 | Fax: +1 613 952-9696 | Diane.Hull@nrc-cnrc.gc.ca 100 Sussex Drive, Ottawa, ON K1A 0R6 | www.nrc-cnrc.gc.ca/main_e.html Frances Isaacs Manager, Strategy and Development International Relations (613) 993-4808 frances.isaacs@nrc-cnrc.gc.ca
9:00 – 9:15	Welcome / Introductions by Pierre Naud	
9:15 – 10:15	Overview of NRC's Strategy and Business Planning Process by **Dr. Carl Caron** and **Dr. Bruce Baskerville**	
10:15 –10:30	Break	
10:30 –12:00	Q&A / Discussion	

12:30 –13:30	Lunch **PM Session: NRC Institute for Biological Sciences, Room 3109** Overview of NRC-IBS and glycobiology activities by J.R. Brisson Tour of Institute's glycoanalysis and proteomics facilities by all Mass Spectrometry Glycoanalysis by Jianjun Li NMR Glycoanalysis by Harold Jarrell Proteomics, Host-Pathogen Interactions by Sue Twine Glycoproteomics by Jennifer Hill Break room 3109 Q&A / Discussion	
13:30 –13:50		
13:50 –15:00		
13:50 -14:05		
14:05 -14:20		
14:20 -14:40		
14:40-15:00		
15:00-15:15		
15:15–16:30		
16:30	Departure by Embassy van to the hotel	
19:15	Gather in lobby	
19:30	Dining at **Metropolitan Brasserie**	VAR Philip Reservation 7 pers 700 Sussex drive Ph: 613 5621160
Tuesday 29 September – Ottawa		
8:10 8:15	Gather in Lobby Departure to CFI – 7 to 10 minute walk	
8:30-12:00	**Canada Foundation for Innovation** **- Dr. Eliot A. Phillipson,** President and CEO **- Jac van Beek,** Vice-President, Programs and Planning **- Manon Harvey, Vice-President,** Finance and Corporate Services **- Suzanne Corbeil,** Vice-President, External Relations and Communications	230 Queen Street Boardroom (4Fl) Ottawa, ON K1P 5E4 **POC:** Sylvie Paul-Hus, Executive Assistant, Executive Offices phone: 613-947-7260 e-mail: sylvie.paul-hus@innovation.ca e-mail: eliot.phillipson@innovation.ca
	15 minute walk to restaurant	
12:30	**Restaurant Wilfrid's in 'Chateau Laurier'**	1 Rideau Street Ottawa, ON Ph: 613-241 1414 VAR Philip de Waal
13:45	Depart to NSERC	
13:55	Meet Noel Burns at 13 Fl.	
14:00-16:20	**Natural Sciences and Engineering Research Council of Canada (NSERC)**	NSERC – CRSNG, Room 13 – 145 (13th floor) 350 Albert St (Constitution Square)

		Ottawa ON, K1A 1H5
14:00	Welcome address by **Dr. Suzanne Fortier**, NSERC President	**PoC :** Noel Burns International Relations Analyst Policy & International Relations E -Mail: noel.burns@nserc-crsng.gc.ca Tel : 613) 995-5943 Marie Claude Caron Tél. : (613) 992-3445
14:10	Presentation of "ERA-Instruments - Infrastructure funding in the Life Sciences" **Dr. Thomas Gubitz** - DFG	
14:20	Presentations from ERA-Instruments delegation members	
14:50	Presentations from NSERC and the Networks of Centres of Excellence • "NSERC Overview" **Marie Claude Caron,** Manager, Policy & International Relations, **Serge Villemure and Pierre Bilodeau,** Directors of Research Partnerships and Research Grants "Networks of Centres of Excellence - Mobilizing Research for Canada's Advantage" by **Jean-Claude Gavrel**	
15:20-16:00	Questions and Discussion	
16:30-17:30	Meeting with **Ambassador Wim Geerts** at the Royal Netherlands Embassy	Royal Netherlands Embassy 350 Albert Street, Suite 2020
19:00	Diner at restaurant '**Social**'	537 Sussex drive, Ottawa Ph: 613 789 7355
Wednesday 30 September Ottawa / Montreal		
8:25	Check-out and leave luggage at Bell boy in hotel	
8:40	Depart to Genome Canada 2 minutes by taxi / 10 minute walk	
9:00-11:30	**Genome Canada** **Dr. Cindy Bell**, Executive Vice President, Corporate Development **Dr. Karl Tibelius**, VP Genomics Programs	150 Metcalfe Street, Suite 2100 Ottawa, ON K2P 1P1 **POC:** Cindy Bell Ph.D. cbell@genomecanada.ca Phone: 613-751-4460 ext 118 Julie Bernier, administration assistant jbernier@genome.ca Phone: 613-751-4460, ext. 114
11:30-11:45	Depart to Hotel (10 mins walk) to pick up luggage	
12:00	Depart by taxi to Train station	10 min drive to station: 200 Trembley Rd, Ottawa, ON, Canada
12:15	Check in at kiosk with voucher to reclaim your ticket for train nr.634 leaving at 13:05	

13:05-15:02	**Travel from Ottawa to Montreal by train no. 634** Lunch included	
	Take taxi to hotel (5 minutes)	
15:30	Check-in at **Hotel Place d' Armes** 55, St-Jacques Street West Old Montreal, Quebec H2Y 3X2 +1-888-450 1887 http://www.hotelplacedarmes.com/	
Meeting up with the delegation from the HUPO conference - Dr. Andrew Pitt Managing Director RASOR consortium, Director Sir Henry Wellcome Functional Genomics Facility and Senior Lecturer Proteomics, University of Glasgow - Dr. Christian Rolando CNRS, Chimie organique et macromoléculaire - Prof.dr. Dietmar J. Manstein Director of the Institute for Biophysical Chemistry and Laboratory for Structure Analysis at Hannover Medical School		
19:00	Gather in lobby and dinner location tbd	
Thursday 1 October – Montreal		
08:45	Check-out hotel and leave luggage at Bell boy to be picked up after visit McGill Genome Quebec Innovation Center	
09:00	Depart for NRC (20-30 min)	
9:25 arrival NRC		
09:30-12:00	***NRC Biotechnology Research Institute (NRC-BRI)*** **Dr. Andrew Storer**, Director of Health	6100 Royalmount avenue, Montréal, Quebec H4P 2R2 **POC:** Ms. Claude Garneau 514-4966101 Claude.garneau@cnrc-nrc.gr.ca Dr. Andrew Storer Tel.: (514) 496-6256 Fax: (514) 496-1629 E-mail: andrew.storer@cnrc-nrc.gc.ca
12:30–13:40	Lunch at Restaurant L' 'Academie	2100 Crescent, Montréal, Québec, H3G 2B8 (514) 664 - 4455 15 minutes walk to McGill
14:00-17:00	**McGill University and Génome Québec Innovation Centre** **Dr. Ken Dewar, Acting Scientific Director** **Daniel Tessier, Senior Director Operations and Business Development, Genome Quebec**	740, Dr Penfield Avenue, W-side or East side campus entrance 6 Fl. Room 6001 Montréal (Québec) Canada H3A 1A4 **PoC:** Daniel Tessier dtessier@genomequebec.com 630, boul. René-Lévesque West Suite 2660 Montréal (Québec) H3B 1S6 Tel.: (514) 398-7199

		ken.dewar@mcgill.ca Phone: 514-398-3311/Fax: 514-398-1790
17:00-18:00	Transfer to hotel to pick up luggage and continue to Montréal-Pierre Elliott Trudeau International Airport	
18:00	Check-in and informal dinner at the airport after security check	
20:00	Travel to Toronto by **flight no.AC 427**	
22:00	Check-in at **Sutton Place Hotel** 955 Bay Street Toronto, Ontario, Canada M5S 2A2 Tel: 416.924.9221 Fax 416.924.1778 http://www.toronto.suttonplace.com/	Late check in!
Friday 2 October – Toronto		
08:40	Gather in Lobby 10 minute walk to MaRS Centre	
9:00-2:30pm (incl lunch) 9:00 AM 9:45 AM 10:30 AM 11:30 AM 12:15 13:00 PM 14:30 PM 15:00 PM	**MaRS Centre** **Ontario Institute for Cancer Research Thomas J. Hudson** President and Scientific Director + **Structural Genomics Consortium CHERYL ARROWSMITH Ph.D, chief scientist** (www.sgc.utoronto.ca) **Cheryl Arrowsmith,** Director SGC Toronto Laboratories "Overview of SCG Toronto programs" **Tom Hudson,** President and Scientific Director, OICR "Overview of OICR and presentation of genomics and informatics platforms" Break and tour of OICR facilities **Vladimir Baranov**, DVS Technologies "CyTOF™ massively multiplex analysis of individual cells" Lunch and individual discussions with scientists **Raymond Hui,** Scientist SGC Toronto Laboratories "Tour of SGC laboratories and infrastructure facilities" **David Jaffray**, Head, Radiation Physics, Princess Margaret Hospital "Imaging research and facilities at the STTARR Innovation Centre"	MaRS Centre, South Tower 8nd Fl. Board room 101 College Street, Suite 800 Toronto, Ontario, Canada M5G 0A3 **PoC:** Valerie Foote and Robert A. Phillips, PhD, Deputy Director Tel: 416-673-6630 Email bob.phillips@oicr.on.ca Assistant: Carmen Serban Tel: 416-673-6528 Email: carmen.serban@oicr.on.ca POC SGC: Rebecca Clare Assistant to Dr. Cheryl Arrowsmith Structural Genomics Consortium University of Toronto Rm 705, 7th Floor MaRS South Tower, 101 College St. Toronto, ON M5G 1L7 Tel: 416-946-0237 Fax: 416-946-0880 Email: rebecca.clare@utoronto.ca

	David Jaffray and Juston Grant, Program manager, STTARR Program, Princess Margaret Hospital and tour of STTARR Facility	
16:00	Back to hotel and evaluation of study tour	
19:00	Gather in lobby and closing dinner	