Fighting Disease – Fostering Innovation

THE REPORT OF THE INTERNATIONAL CENTRE FOR INFECTIOUS DISEASES TASK FORCE

November, 2003

Canada

Manitoba

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A SPECIAL TRIBUTE

The task force co-chairs would like to acknowledge the late Jim Orzechowski – architect, colleague and CEO of Smith Carter Architects and Engineers Incorporated. Jim's vision and unrelenting search for knowledge and excellence in infectious disease facilities will continue to inspire us.

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November 2003

The Honourable Rey Pagtakhan
Minister of Veterans Affairs
and Secretary of State
(Science, Research and Development)
Government of Canada
Ottawa

The Honourable Tim Sale
Minister of Energy, Science and Technology
Government of Manitoba
Winnipeg

Dear Ministers:

On behalf of our fellow members, we have the honour of providing you with the report of the International Centre for Infectious Diseases Task Force.

Our report and recommendations address the national challenges of improving public health and enabling Canada to make a greater contribution to fight infectious disease on a global scale. The report also addresses the challenges of community development, and examines how Manitoba's investments in health care concerning infectious diseases can provide leverage for economic development and employment growth in the province.

We want to acknowledge the funding received from Western Economic Diversification and Manitoba Energy, Science and Technology to support our work, as well as the critical role played by the Health Care Products Association of Manitoba, the project's proponent.

We recognize that this proposal carries a substantial price tag. However, we believe it is a necessary and valuable investment for the future well-being of all Canadians. The joint contribution by our three levels of government over a five-year period makes the cost affordable. Proceeding with the recommendations in this report will not only reduce the risks of infectious disease to the Canadian population - it will also help us build an innovative, knowledge-based economy.

This report's recommendations reflect a strong consensus of the task force members, although not absolute agreement on every point. It is, however, our clear and unanimous position that Canada must invest more extensively and wisely in infectious disease research, and take full advantage of our resources to generate new products for prevention and treatment.

We appreciate the initiative you have shown in pursuing this task force's input and involvement. We are confident that you and your officials will give our report your utmost attention and consideration.

Terry Duguid
Co-Chair

Frank Plummer
Co-Chair

INTERNATIONAL CENTRE FOR INFECTIOUS DISEASES TASK FORCE

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of Manitoba

The task force wishes to acknowledge the participation and contribution of the ex-officio members: Dave Boldt, Western Economic Diversification; Stuart Duncan, Destination Winnipeg Inc.; Lea Girman, Province of Manitoba.

Document photos courtesy of: Cangene Corporation, National Microbiology Laboratory, National Research Council (NRC), NRC Institute for Biodiagnostics, Smith Carter Architects, University of Manitoba.

Executive Summary

The governments of Canada and Manitoba jointly created the International Centre for Infectious Diseases (ICID) Task Force to identify how economic and community development opportunities could be pursued for a Winnipeg cluster of health and life sciences research, academic and industry organizations involved in infectious diseases.

The focus on Manitoba acknowledges its position as the hub of Canada's infectious disease research and development activity. The province's infrastructure of facilities and human resources in this field is unmatched. Many of Canada's leading infectious disease researchers and practitioners have received some or all of their training at the University of Manitoba. The international research program between the University of Manitoba and the University of Nairobi is the model for successful international research collaboration.

The human cost of infectious diseases is staggering in terms of death and disability. New research linking infectious diseases with other severe illnesses, like cancer and arthritis, suggests that the toll on the world's populations is even more serious than previously believed. At the same time, the economic impact of infectious diseases continues to strain our health care resources. The Severe Acute Respiratory Syndrome (SARS) outbreak was estimated to have cost the Toronto economy $30 million each day.

The potential exists to prevent and manage diseases to a far greater extent than is being done now. We need to invest in the research, facilities and innovation that will protect, diagnose and treat Canadians and reduce their public health risks. Canada requires robust research, applied science and innovative products to do its part to improve the public health status.

Canada's investment in the fight against infectious diseases must include strategies to maximize the nation's economic development potential. Canada's research resources, particularly those within government, should lead to the commercialization of technologies and inventive new methods in prevention and treatment, resulting in widespread benefits for Canadians. The international collaboration that Manitoba has already demonstrated should be reinforced by further co-operation and improved networks among Canadian researchers and institutions. The development of new business activities associated with infectious disease research can include creating new and growing companies in pharmaceuticals, vaccines, training, analytical laboratories and support services. For instance, the architects who built the Winnipeg federal laboratories now sell their expertise around the world. Strengthening Canada's research and activities in this field will continue to have extensive spin-off benefits throughout the economy.

The vision of the task force is for the International Centre for Infectious Diseases to be a world leader in research, training, commercialization and innovation in addressing the threat and impacts of infectious diseases. The centre will play a critical role in Canada's fight against infectious diseases, as well as serve as the nexus of an integrated cluster of institutions and capabilities in Manitoba.

The task force is making recommendations in three areas: a new international institution, an innovative biomedical development zone and a set of initiatives intended to reinforce Canada's capabilities to deal with infectious diseases.

The task force recommends the creation of the International Centre for Infectious Diseases in Winnipeg with four components and responsibilities:

- **ICID Research Institute** – to conduct contract research, carry out scientific and analytical projects, foster collaboration among scientists and provide mentoring for young scientists and professionals
- **ICID Training Program** – to deliver infectious disease educational services, training, and instructional courses to Canadian and international students and organizations
- **ICID Innovation Facility** – a business development incubator to co-ordinate contract research, facilitate researchers' consulting assignments and bring inventions to the marketplace through licensing, spin-off companies and partnering
- **ICID Charitable Foundation** – to support innovation, research and public outreach by providing funds raised in innovative ways and from sources that would not otherwise be pursued

Overall, the International Centre for Infectious Diseases will work with government researchers, universities and the private sector to bridge gaps that exist among public and private institutions. It will build upon and co-ordinate the existing capabilities and strengths from across Canada. The centre's governance and organizational structure will give it the flexibility to provide innovative services and encourage collaboration among other institutions.

The task force recommends the establishment and development of a special development zone, BioMed City, for the Manitoba infectious disease cluster.

The declaration of specialized land use in the vicinity of the Canadian Science Centre for Human and Animal Health will lead to strategic marketing and promotion to foster the growth of Manitoba's infectious disease and life sciences cluster. BioMed City will become an area where research laboratories and academic resources can provide synergies for new research, product development, commercialization and company start-ups. It will also attract companies seeking to develop in proximity to others in the infectious disease field.

The task force recommends that federal and provincial governments work with universities and public institutions to introduce measures that reinforce the anticipated work of the International Centre for Infectious Diseases and BioMed City. These measures should include:

- establishing a joint program by the Province of Manitoba and the State of Georgia for their complementary growth of infectious disease capabilities and related business development
- developing an epidemiology network in Manitoba
- building educational and training programs to reinforce Canada's capacity in public health, bioinformatics, biosafety and technology transfer
- endowing five research chairs at the International Centre for Infectious Diseases
- integrating the Manitoba infectious disease laboratories
- establishing extensive networks to reinforce the capabilities of research scientists

Implementing these recommendations will require two initial steps. The first is to form a **tripartite agreement among the Government of Canada, the Province of Manitoba and the City of Winnipeg** to establish contribution levels and set aside the $50–$60 million required to implement the recommendations.

The second step is to **develop a business plan to enable the governments to proceed with clear guidance** on how they should implement the task force's recommendations. The business plan should specify, in detail, the projected costs of each component, funding options, governance arrangements and sequence of decisions, to make the International Centre for Infectious Diseases a reality.

1. INTRODUCTION

Infectious disease outbreaks and epidemics – whether naturally occurring, passed on by animals or caused by bioterrorism – are challenging our global resources and scientific ingenuity. The strategies that Canada and Manitoba will adopt to address these challenges are crucial to our public health and well-being, as well as that of others throughout the world, and are fundamental to the obligation of governments to protect their citizens.

The focus on Manitoba acknowledges its position as the major hub of Canada's infectious disease research and development activity.

Effective containment of infectious diseases requires intensive research, innovation in public policy and rigorous discipline of applied science. It obliges Canadians to invest further in facilities and infrastructure to strengthen preventive medical programs and disease surveillance. At the same time, the control and treatment of infectious diseases should figure more prominently in Canada's economic development strategies to leverage health care investments. Our creativity and ability to find new solutions will continue to be put to the test.

1.1 Task Force Mandate

In April 2003, the governments of Canada and Manitoba jointly created the International Centre for Infectious Diseases (ICID) Task Force. Our mandate from the Honourable Rey Pagtakhan of the Government of Canada and the Honourable Tim Sale of the Government of Manitoba was to identify how economic and community development opportunities could be pursued for the Winnipeg cluster of health and life sciences research, academic and industry organizations involved in infectious diseases.

The focus on Manitoba acknowledges its position as the major hub of Canada's infectious disease research and development activity. For example, the province's medical and clinical education, and its research and international programs, are recognized for their national and international academic excellence. Manitoba's expertise and capacity in infectious diseases enabled the task force to concentrate on the practical measures needed to build on existing resources in Manitoba and across Canada.

The starting point for consideration by this federal-provincial task force was the Canadian Science Centre for Human and Animal Health, which houses Health Canada's National Microbiology Laboratory and the Canadian Food Inspection Agency's National Centre for Foreign Animal Disease. These laboratories have become a mainstay for the country's critical mass of researchers and organizations involved in infectious diseases. Their proximity and relationships with the University of Manitoba's research and clinical training facilities have helped consolidate the centre's leadership position.

In May 2003, the task force began reviewing infrastructure development needs, investment requirements and commercialization opportunities, as well as economic benefits that accrue from government laboratory and university research. We considered barriers as well as opportunities and bridges, and the capacity in Canada and elsewhere to identify and contain infectious diseases. The analysis identified gaps that require additional resources to support existing infrastructure, expertise and innovation.

1.2 Establishing Capabilities: Progress to Date

While Canada has considerable capacity to deal with infectious diseases, it has not yet taken full advantage of the potential to expand it and fulfil critical public health needs around the world. Manitoba, however, has made significant progress in building its extensive cluster of institutions and scientific expertise in this field.

The University of Manitoba has played a leading role in the development of academic resources in infectious diseases. In the late 1960s, under the leadership of Dr. Jack Wilt, the disciplines of clinical infectious diseases, clinical microbiology and basic medical microbiology were integrated into a single unit. The subsequent recruitment of Dr. Allan Ronald, and his energetic and pragmatic vision of research excellence, resulted in the University of Manitoba becoming Canada's leading research and training venue in this field. Indeed, many of Canada's leading infectious disease researchers and practitioners have received some or all of their training at the University of Manitoba. Furthermore, the development of an international research program between the University of Manitoba and the University of Nairobi has become the model for successful international research collaboration.

Indeed, many of Canada's leading infectious disease researchers and practitioners have received some or all of their training at the University of Manitoba.

The concept of an International Centre for Infectious Diseases was originally formed in 1999, when critical needs were identified that could not be adequately addressed by existing government, academic and health care organizations. As it was conceived four years ago, the International Centre for Infectious Diseases was to bring together scientific resources and capabilities in a joint venture to enable more concerted and integrated research, diagnosis, treatment and economic development. The opportunity for synergies was substantial, but the organizational framework to enable collaboration among the institutions and disciplines was missing.

This centre was to co-ordinate the work of the proposed partners at that time, which included Health Canada, the University of Manitoba, Manitoba Health and the Winnipeg Regional Health Authority. Additional partners were identified from international research agencies and institutions in the United States, the United Kingdom, Africa and India, as well as from the private sector, one of these initially being Cangene Corporation.

The founding vision was that the International Centre for Infectious Diseases would achieve excellence in public health programming, conduct research to inform health policy and contribute to better health for Canadians and others through cutting-edge research. The centre was to incorporate outstanding research training programs, become a nucleus of the knowledge economy and facilitate the commercialization of scientific discovery. It was described in the following way in the September 2001 TDV Global Inc. proposal to establish a business plan:

> The ICID would be THE centre of infectious disease in Canada and a major world player. Envisaged is a doubling of the microbiology and infectious diseases community in Manitoba and a need for additional funding from Health Canada. The wide-ranging membership of the ICID would facilitate the leveraging of funds from a variety of national and international programs and could lead to important business opportunities that might not otherwise be available to individual members.

CANADIAN SCIENCE CENTRE FOR HUMAN AND ANIMAL HEALTH

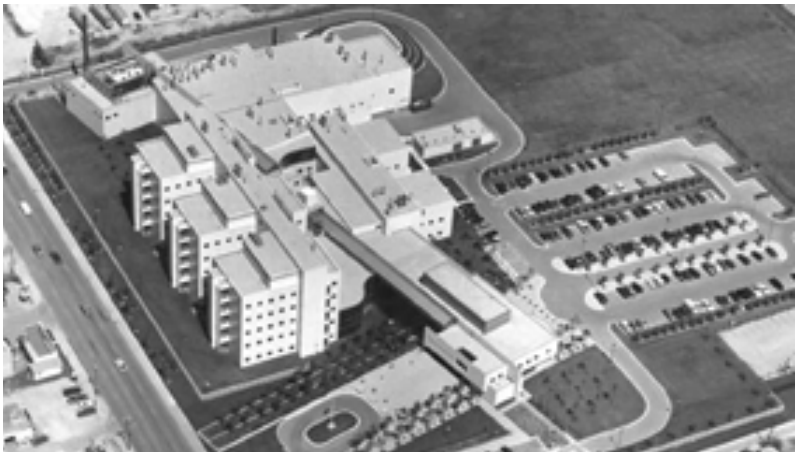
Manitoba's reputation in infectious disease education and its pre-eminent scientific training for Canada's researchers, formed the basis of the decision to locate the Canadian Science Centre for Human and Animal Health in Winnipeg. While some Ottawa critics claimed political motives, Canadians who understood Manitoba's scientific assets and expertise knew better.

It is Canada's premier institution of research into the cause, treatment and control of infectious diseases. It is Health Canada's elite national laboratory, one of the few in the world capable of dealing with a full range of deadly organisms and unlocking the secrets of effective diagnosis and therapies. It has established scientific and technical links with institutions across the globe, including close working relationships with the U.S. Centers for Disease Control and Prevention.

Built and equipped at a cost of $180 million, it opened in Winnipeg in 1997. It is one of the most advanced laboratory facilities in the world – its replacement cost today would be $500 million. Employing 230 scientists, technicians and support staff, the centre is the sole facility worldwide with Level 4 biocontainment laboratories for both human and animal health.

Co-locating the National Microbiology Laboratory and the National Centre for Foreign Animal Disease under one roof makes this facility truly unique. Both labs have crucial roles to play in the country's preparedness and response to infectious disease threats to human health and agriculture. Their integrated working research and crisis response situations will become increasingly indispensable for this task.

The scientists at the Canadian Science Centre for Human and Animal Health provide research, diagnosis and analysis of emerging and perplexing communicable diseases. Their instrumental roles in, and quick analytical responses to, the recent SARS and Bovine Spongiform Encephalopathy (BSE) crises illustrate their expertise and capabilities.



The Canadian Science Centre for Human and Animal Health, located in Winnipeg, Manitoba, houses the only Level 4 laboratories in the world for both humans and animals.

That same proposal went on to describe an essential ingredient for success:

> Achieving the ICID will require "out-of-the-box" thinking, a change in culture for those who are used to working within one regime (be it public, private or academic), a passion for excellence, hard work, teamwork, and a will to make it happen.

From the beginning of the task force's work, it was apparent that considerable progress had already been made in realizing the centre's vision. (See Building the Dream – inside back cover) For example, while still in its conceptual phase in 2002, the International Centre for Infectious Diseases was awarded funding, through the University of Manitoba, to anchor a training program sponsored by the Canadian Institutes of Health Research, the University of Manitoba, and the Province of Manitoba. Totalling nearly $4 million over six years, this multi-disciplinary training program uses international experts at the University of Manitoba and other institutions, and grants them access to unique facilities at the Canadian Science Centre for Human and Animal Health.

As it stands, the International Centre for Infectious Diseases is still in its formative stages. This task force has been given the responsibility, through its joint federal-provincial mandate, to define it and provide guidance on the structure, functions, mandate and resources that are needed. The task force has been asked to consider measures that build on the institutions and knowledge capital that constitute Manitoba's infectious disease cluster, and the infrastructure to support and complement the International Centre for Infectious Diseases, as well as the economic and community development opportunities flowing from it.

2. VISION

The concept and objectives of the International Centre for Infectious Diseases, as they were initially proposed, are endorsed by the task force. They provide a valid rationale for its establishment. At the same time, we recommend a broader mission, and more encompassing activities, to serve as a basis for proceeding.

Here is the task force's vision for the new organization:

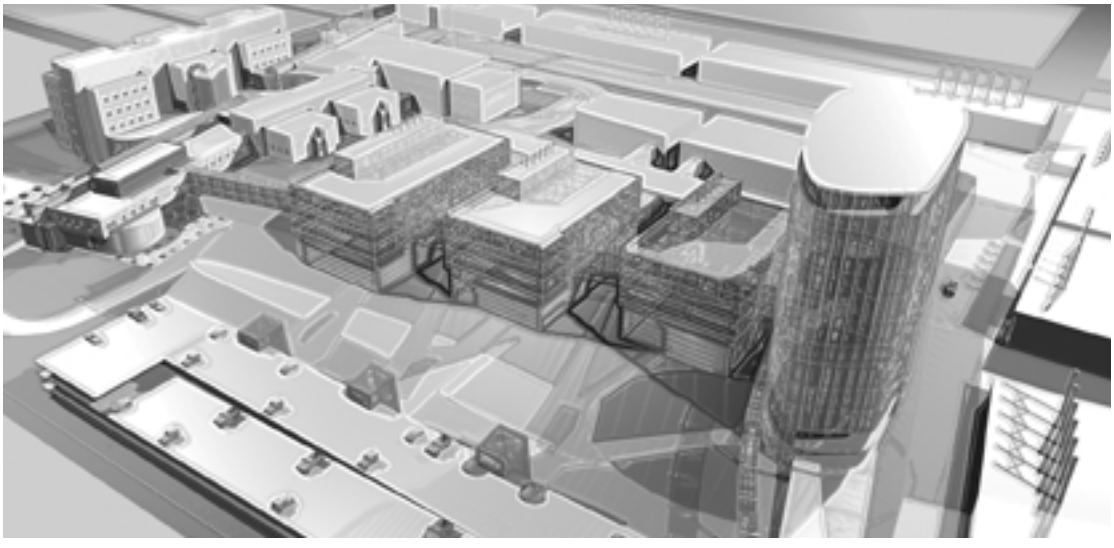
The International Centre for Infectious Diseases will be a world leader in research, training, commercialization and innovation in addressing the threats and impacts of infectious diseases. The centre will play a critical role in Canada's fight against infectious diseases, as well as act as the nexus of an integrated cluster of institutions and capabilities in Manitoba.

The task force sees the International Centre for Infectious Diseases as:

- an organization to foster creative thinking, innovation, worldwide collaboration and commercialization
- Canada's pre-eminent contributor to infectious diseases research
- a principal facilitator of Canadian training in infectious disease identification and prevention
- the anchor to a Canada-wide and international network of public and private sector activity in the identification and prevention of infectious diseases
- the core of a Manitoba-based cluster in research and related activity that includes public infrastructure, commercial enterprises and connectivity across the public and private sectors

We expect the ICID to achieve humanitarian objectives worldwide through improved health care, and economic benefits in Canada through wealth creation and community development.

The mission of the International Centre for Infectious Diseases will be to promote and conduct basic and applied research, train researchers and technicians, and facilitate the commercialization of technology through the development of products and services. We expect the ICID to achieve humanitarian objectives worldwide through improved health care, and economic benefits in Canada through wealth creation and community development.



Future vision of BioMed City – the International Centre for Infectious Diseases complex.

3. REFORMING THE PUBLIC HEALTH SYSTEM

The task force was formed prior to discussions that took place between federal and provincial governments about the shortcomings in Canada's public health system, which became apparent during recent high-profile infectious disease outbreaks.

These discussions included the consideration that Canada adopt an institutional structure similar to the Centers for Disease Control and Prevention (CDC) based in Atlanta, Georgia, and the suggestion that Canada emulate its success.

...the CDC attributes much of its success to the co-location of the critical functions of laboratories, epidemiology and crisis response – all working together to fight disease outbreaks.

The National Advisory Committee on SARS and Public Health (Naylor Committee) subsequently reviewed the circumstances of the SARS outbreak and the lessons learned from the experience. They recommended institutional changes at the national level, including the establishment of a Canadian Agency for Public Health, led by a national Chief Public Health Officer, to consolidate the functions of testing, diagnosis, epidemiology and outbreak response management. In essence, the new agency would combine key functions performed in the United States by the CDC. It would establish a made-in-Canada model that recognizes the value of collaboration. Meanwhile, the CDC attributes much of its success to the co-location of the critical functions of laboratories, epidemiology and crisis response – all working together to fight disease outbreaks.

Federal Health Minister Anne McLellan commented that Canada should be looking at a national institution involving federal, provincial and territorial collaboration, and that there should be agreement about what it should look like and what its component parts might be. Manitoba Premier Gary Doer pointed out that Manitoba-based scientists and facilities working in this field are already at the forefront of Canada's effort, and should be encouraged to continue in their effective leadership role.

The mandate for the International Centre for Infectious Diseases Task Force did not include a request for advice on the location of the Canadian Agency for Public Health or the facility for infectious disease outbreak co-ordination. However, we believe that the principles and criteria for the selection of a site for the new Canadian Agency for Public Health and the infectious diseases co-ordination facility should be based primarily on scientific and public health merits rather than other considerations. As well, the choice of a location for the new institutions should not preclude the growth and expansion of infectious disease facilities across Canada. These specialized research and health care institutions should continue to play essential roles within a co-ordinated system.

The decisions related to the proposed Canadian Agency for Public Health and infectious disease co-ordination facility are separate from those regarding the International Centre for Infectious Diseases. The purposes of the organizations will be different, but complementary. They are each, in their own way, intended to build Canada's capability to more effectively protect the health of Canadians and reduce risks of infectious diseases.

THE AMERICAN STRUCTURE

Two of the primary public health agencies in the United States are:

• CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

The lead agency in the United States is the Centers for Disease Control and Prevention, based in Atlanta. Its National Centre for Infectious Diseases is one of 11 components, each dealing with specialized diseases, such as environmental and occupational health. While the CDC is perceived to be primarily involved in infectious diseases, most of its employees deal with other disease issues.

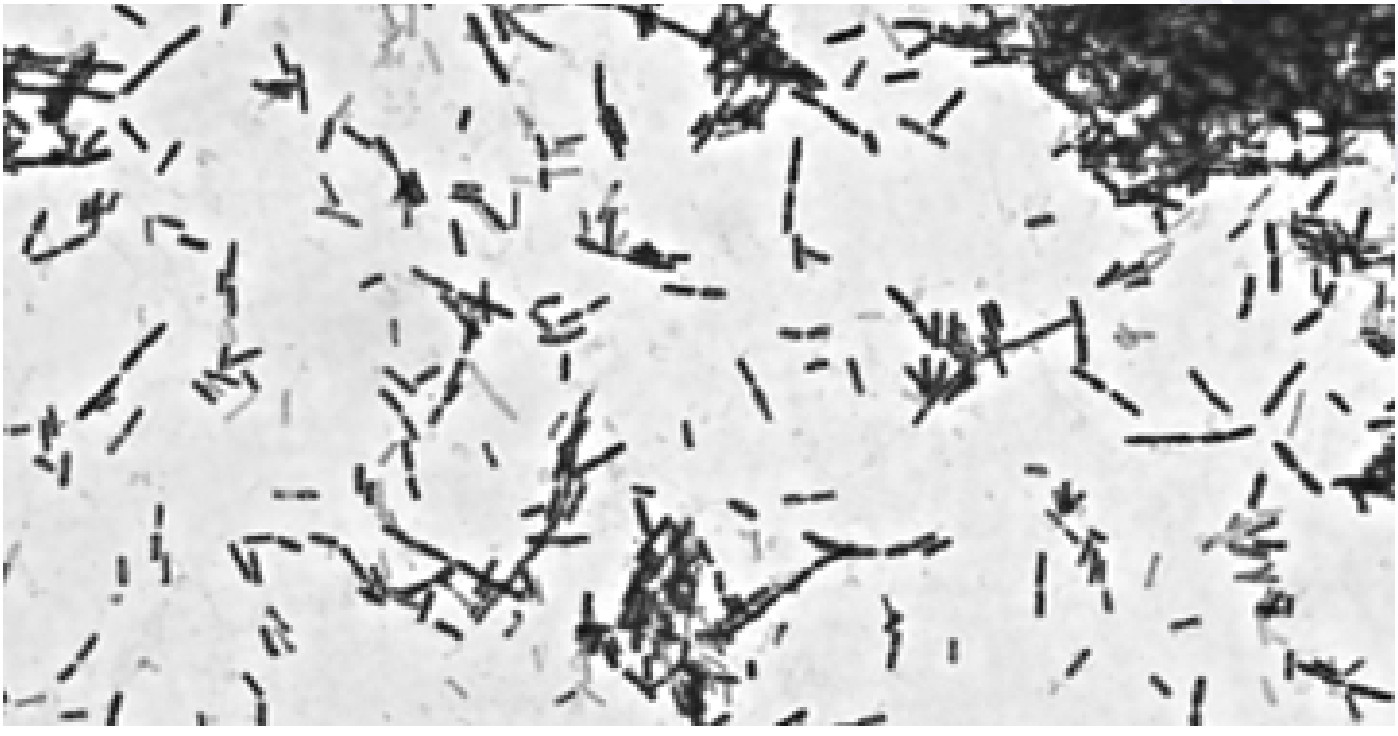
The CDC has achieved a worldwide reputation from its readiness to respond to disease outbreaks across the globe. It is an authoritative source of public information and health alerts. It has an extraordinary economic impact, employing 9,000 people worldwide, and nearly 6,000 of these in Georgia at three campuses and over 30 office facilities. The CDC's 2003 budget was $4.8 billion for infectious disease prevention, control, crisis response and terrorism.

Until recently, the CDC was not actively involved in building relationships with the Atlanta business community or transferring technology to biomedical companies, but those bridges are now being built. Its researchers have incentives to carry out applied research as a result of federal legislation that permits them to collect royalties from technology transfer activities.

An innovative institutional development at the CDC was the 1995 creation of an independent charitable foundation to seek new sources of funding for health programs. The CDC Foundation is a non-profit organization that accepts donations from individuals and companies, including endowments and corporate sponsorships. Through the foundation, CDC scientists can act on a contract basis with universities and governments (but not companies) that wish to access their expertise.

• NATIONAL INSTITUTES OF HEALTH (NIH)

Similar in some respects to the CDC, the U.S. National Institutes of Health co-ordinates activities of 27 institutes and centers in medical and health-related disciplines. The goal of the NIH is to develop new knowledge for disease prevention, detection, diagnosis and treatment. The NIH conducts its own research and funds scientific projects at universities, medical schools, hospitals and research institutions, both in the United States and around the world. The NIH has a budget of $24 billion, out of which $2 billion is reserved for its internal research centers. The facility operates on a decentralized basis and has a low public profile as a research organization, particularly regarding long-term scientific research. It fosters close relationships with the CDC, especially with its disease-related institutes and projects. In some respects, the NIH acts as the basic scientific research source for much of what the CDC then applies in practice in its analysis, diagnosis and treatment.



The U.S. Centers for Disease Control and Prevention played a role in identifying the anthrax bacteria (pictured above) distributed through the U.S. mail in 2001.

4. FIGHTING INFECTIOUS DISEASES

Although improved hygiene, vaccines and antibiotics help protect us against some infectious diseases, the threats posed by infectious diseases are ever-changing and unpredictable. Globally, two-thirds of deaths in people under 45 are caused by infectious diseases. The experiences of recent years highlight Canadian vulnerability to these threats and the need for robust scientific capacity to counter them.

4.1 Impacts of Infectious Diseases

With the emergence of recent infectious disease outbreaks, the repercussions have become unmistakable to Canadians. Public awareness is extraordinarily high, as is the concern about Canada's readiness for future outbreaks. The litany of diseases and their acronyms – severe acute respiratory syndrome (SARS), bovine spongiform encephalopathy (BSE), human immunodeficiency virus (HIV), acquired immunodeficiency syndrome (AIDS) – have become part of the everyday vocabulary of Canadians. The sudden and unexpected impact of these diseases has raised Canadians' awareness of global conditions and the massive challenges inherent in coping with these new realities.

West Nile, a zoonotic virus transmitted by mosquitoes, emerged in New York in 1999 and swept across North America.

Two-thirds of human infectious diseases are either zoonotic or of zoonotic origin, underlining the need to understand both human and animal diseases.

The toll on Canada from the outbreak and spread of communicable diseases has been substantial in both human and economic terms. While the numbers of Canadian victims are small relative to other parts of the world, the impact has given Canadians a new perspective on their personal vulnerability. In the early stages of the SARS outbreak in late April, it was estimated that Toronto was losing $30 million a day from the decline in economic activity. At that point, *Time* magazine reported that the global cost of SARS was approaching $30 billion US. The costs of only one case of BSE have been estimated at $11 million per day to the Canadian economy and the loss of 5,000 jobs.

The concern about infectious diseases is not limited to the ones brought into the country from elsewhere. Homegrown infectious diseases are gaining public attention. For example, a recent study sponsored by Health Canada found that as many as 80 per cent of Canadian hospitals fall seriously short in preventing patients from getting hospital infections. Each year, about 250,000 hospital patients experience infected surgical wounds, blood infections or antibiotic-resistant bacteria, and 8,000 of these people die.

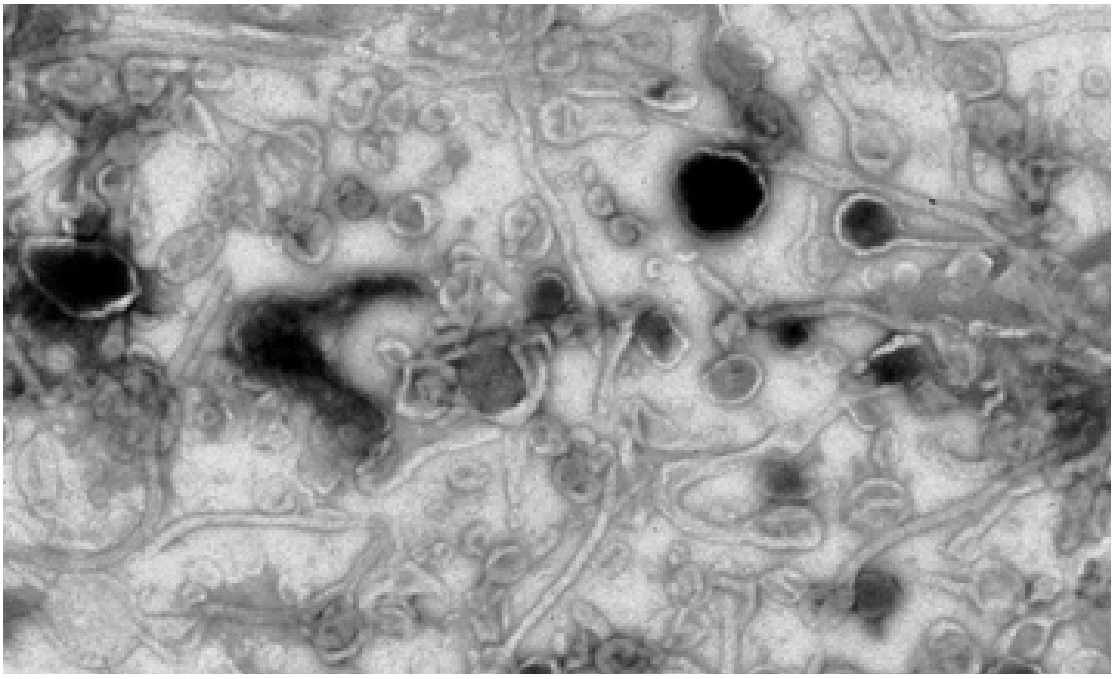
The transmission of some infectious diseases has been a long-standing problem in Manitoba Aboriginal communities, particularly those diseases affecting children. There are instances of new and reactivated tuberculosis, recurring pneumonia and bronchitis in First Nations communities. Shigellosis, a highly infectious diarrheal disease, has also emerged. Attempts to cope with these challenges in small, isolated Aboriginal communities strain the capacity of our health care system and strengthen the rationale for increasing medical research and addressing prevention and treatment.

The prevention of infectious diseases can result in significant cost savings. The vaccination program in Canada has saved billions of dollars through avoiding productivity losses and reducing disease treatment requirements. For example, the cost avoidance from vaccinations for Haemophilus influenzae type B alone has been conservatively estimated at $37 million per year. Therefore, the development of new vaccines to prevent diseases like West Nile and SARS could result in enormous savings.

There is a growing concern about zoonotic diseases like West Nile and hanta virus, which can be transmitted to humans by animals or insects such as mosquitoes. An important strategy in disease control is managing animal and insect populations that harbour or transmit these diseases. Diseases of zoonotic origin are first passed to humans by animals, but can then be spread through human-to-human contact. Influenza, AIDS and SARS are examples of diseases thought to have an animal origin. Two-thirds of human infectious diseases are either zoonotic or of zoonotic origin, underlining the need to understand both human and animal diseases.

The costs of investing in research, preventive measures and outbreak response capabilities are insignificant when compared to the overwhelming cost of being caught unprepared during the next serious infectious disease outbreak, such as SARS.

Infectious diseases have recently been identified as triggers, or factors, in the incidence of cancer, heart disease, ulcers, autoimmune diseases and mental illness. Hepatitis B has been linked to liver cancer, and human papilloma virus is the major cause of cervical cancer. *Helicobactor pylori* has been associated with gastric ulcers and stomach cancer. *Chlamydia pneumoniae* is associated with arterial plaques and heart disease. Certain strains of *E.coli* have been shown to cause reactive arthritis and Crohn's disease has been linked to *Mycobacterium paratuberculosis*. Herpes simplex virus type 2 infection in mothers has been linked with a higher



Scientists at the National Microbiology Laboratory provide research, diagnosis and analysis of deadly infectious diseases like Ebola hemorrhagic fever, pictured above.

incidence of schizophrenia in their grown children. The identification of infectious diseases as causes or aggravating factors for these other diseases and disorders suggests that they are a greater threat and even more damaging to public health than previously believed.

The most recent annual report of the World Health Organization (WHO) presented the glaring human realities from a global perspective, pointing out that infectious diseases caused 14.7 million deaths in 2001. The three most prevalent diseases – AIDS, tuberculosis and malaria – caused 5.6 million of those deaths. Additionally, almost one billion people are afflicted by severe and permanent disabilities and deformities arising from infectious diseases. For example, blindness and leprosy are often brought on by inadequate treatment of populations without access to health services.

During much of the second half of the 20th century, the average lifespan of Africans grew from 40 to 62 years. Since the HIV pandemic, all of those gains seen in the African lifespan have been lost. Indeed, all the population health benefits from the provision of clean water, sewers and universal childhood vaccination strategies have been lost in sub-Saharan Africa due to AIDS.

One of the most obvious tests of the public health system's effectiveness is the ability to deal with surges in disease transmission. Being able to marshal all available analytical and diagnostic resources quickly and create disease specialist teams is essential. At the same time, the significant risk from bioterrorism, and the use of biological instruments as potential political weapons, is as unmistakable as it is unpredictable. One risk receiving increasing attention, and leading to new precautions, involves introducing foreign animal diseases into the food and water supply, to carry out what has been termed agricultural terrorism.

The costs of investing in research, preventive measures and outbreak response capabilities are insignificant when compared to the overwhelming cost of being caught unprepared during the next serious infectious disease outbreak, such as SARS. Canadians are becoming increasingly intolerant of public health risks caused by a failure to invest in sufficient resources. There is no question that the country needs to build a stronger infrastructure of institutions and expertise dedicated to infectious diseases.

The Canadian Science Centre for Human and Animal Health, located on Arlington Street in Winnipeg, Manitoba, is the only Level 4 facility in Canada.

EXAMPLES OF INTERNATIONAL INSTITUTIONS AND AGENCIES

• WORLD HEALTH ORGANIZATION (WHO)

This United Nations agency co-ordinates the work of countries and national governments, reflecting the global nature and increasing pace of disease transmission across national borders. It has declared current global epidemics in influenza, SARS, cholera and malaria. It issues alerts as it tracks and manages evolving outbreaks, in some cases providing personnel, equipment, logistics and supplies to areas and countries in need of immediate resources. The WHO's monitoring includes epidemic intelligence, event detection and verification, information management and dissemination, real time alerts and co-ordinated rapid outbreak response. It has comprehensive databases on epidemics and information on the skills, experience and availability of experts for response teams, and is building its readiness for containment in the event of any incidents involving the intentional release of biological agents. The organization's regulatory framework enables countries to exchange vital information, notifications, and early warnings, as well as have protocols in place to work together at short notice.

• EUROPEAN UNION (EU)

An example of a significant regional health organization is the one formed within the European Union. Its focus is on surveillance systems, informatics and exchanges of technical information among the chief medical officers of the European countries. A series of disease-based networks that share information have strengthened the EU's capacity to recognize emerging problems and understand best practices in responses. It has established a system for early warning and response, in which the ministries of health can rapidly inform each other of outbreaks that are threatening to spread. The arrangements among the countries in the European Union involve co-ordination through a 'network of networks' and regular meetings of the state epidemiologists, medical officers of infectious disease control and other counterparts at various levels of the national public health system. One of the EU's resulting collaborative projects was an inventory of the means to control communicable diseases.

• PAN AMERICAN HEALTH ORGANIZATION (PAHO)

The Pan American Health Organization is also one of several operating at a regional level. Its member states include Canada among the 35 countries co-ordinating their primary health care resources. PAHO is facing the re-emergence of cholera, dengue and tuberculosis – diseases thought to be under control or virtually eliminated – and supports programs to prevent the transmission of diseases, especially in the poorer areas of Latin America. Its technical assistance to member countries includes educational and social communications support for primary health care and training for health care workers through fellowships, courses and seminars. PAHO offers tax-deductibility for charitable contributions to its educational foundation from residents of countries throughout the Americas, including Canada. These funds are earmarked for health and research projects.

• NON-GOVERNMENTAL ORGANIZATIONS (NGOs)

There are hundreds of charitable, religious and relief organizations around the world that provide responses to infectious disease problems. The Red Cross and Doctors Without Borders, among others, are involved in the delivery of health care services, drugs and vaccines on a regular basis and at times of crisis. Their funding typically comes from a combination of government and charitable sources, and is used to cover the costs of an array of essential medical products and services, as well as logistics and travel for the delivery of care.

Researchers at the National Microbiology Laboratory in Winnipeg perform experiments.

4.2 Canada's Approach

Canada's public health institutions, skilled disease professionals, research fields, medical specializations and crisis response plans and processes served Canadians well and went largely unnoticed for decades. When seen from a national perspective, the Canadian public health system, at the delivery level, involves a proficient but fragmented group of government organizations – mainly provincial, regional and municipal agencies – dealing with infectious diseases. While the provinces have been conscientious in carrying out their responsibilities, the system of separate provincial and territorial organizations is not conducive to providing the best results or equipping Canadians with the tools to deal effectively with future disease outbreaks. The Naylor Committee pointed out that the fragmentation of responsibilities and the lack of effetive communication resulted in significant delays in dealing with the SARS crisis in Ontario.

While the provinces have been conscientious in carrying out their responsibilities, the system of separate provincial and territorial organizations is not conducive to providing the best results or equipping Canadians with the tools to deal effectively with future disease outbreaks.

Health Canada, through its Population and Public Health Branch, has national responsibilities for policies, programs and research relating to disease surveillance, illness prevention and control, knowledge dissemination, health promotion and community health projects. A primary mandate of Health Canada is to reduce disease incidence and conditions. Its scientists and health professionals monitor diseases, carry out research on disease surveillance, and generate data and statistics, performing many of the same functions as the U.S. Centers for Disease Control and Prevention.

The events of the past year have led to national initiatives and the start of positive developments for responding to infectious disease outbreaks. For example, to establish synergy, Health Canada has already begun to merge the epidemiology and surveillance activities of its Centre for Infectious Disease Prevention and Control in Ottawa, with the research and analytical functions of its National Microbiology Laboratory in Winnipeg. Canada's strategy for infectious diseases is to respond to the apprehension and rising expectations of Canadians about establishing coherence and co-operation, and to create a system that, first and foremost, maximizes the achievement of national public health objectives.

4.3 Canadian Capabilities

It is important to recognize the nature and structure of Canada's infectious disease resources and the institutions that deliver the services. Despite their fragmented nature, Canada's overall capabilities are extensive, and networks increasingly connect them. The organizations and initiatives highlighted here are just a sample of those that exist across Canada and are meant to be illustrative of the country's abilities.

There are highly renowned institutions, researchers and practitioners in locations around the country. Manitoba scientists are key players in these institutions including the Vaccine and Infectious Disease Organization (VIDO) and the Canadian Network for Vaccines and Immunotherapeutics (CANVAC). Manitoba could be described as having a comprehensive and integrated set of research, educational, diagnostic and treatment institutions and capabilities. In recognition of Manitoba's role as the major hub of Canada's infectious disease research activity, an extensive description is provided in the highlighted page in this section of the report. While other Canadian locations have somewhat similar structures and, in some cases, comparable capabilities in one field or another, Manitoba has a coherent cluster of institutional capabilities and professionals that is unparalleled.

The **British Columbia Centre for Disease Control (BCCDC),** a provider of specialized health support and resource services, provides an example of the role played by the provinces and their agencies in the prevention, detection and control of communicable diseases. Operating as a unit in the regional Vancouver/Richmond Health Board, this centre is involved in epidemiology and laboratory services, as well as the control of sexually transmitted diseases, AIDS, hepatitis and tuberculosis. Its programs include a Drug and Poison Information Centre, Food Protection Services and Radiation Protection Services. Its surveillance and epidemiological analysis provides a basis for developing prevention and disease control policies and programs.

Manitoba has a coherent cluster of institutional capabilities and professionals that is unparalleled.

Another example is the **Vaccine and Infectious Disease Organization (VIDO),** a research institute established in 1975 within the University of Saskatchewan. It is a world leader in vaccine research for the control of infectious diseases in livestock and poultry, and is expanding to zoonotic and human vaccines based on a growing market for these products. Its plans reflect its research, which is based on the trend towards converging animal and human disease, and recognizing the similarities of problems and responses for each.

The **Canadian Network for Vaccines and Immunotherapeutics (CANVAC)** involves collaboration among biopharmaceutical companies, government departments and agencies, and several patient and consumer groups. Its scientists, along with its 25 affiliated universities and research institutions, are working to develop vaccines to protect people across the globe from life-threatening viral infections and other diseases. The organization's strengths lie in its expertise in vaccine improvement, its connections with the key industry players, and its ability to bundle technologies and commercialize intellectual property.

While the International Centre for Infectious Diseases is the focus of this report, it is important to understand it in association with other important new developments. For example, health networks are the focus of the **Canada West Health Innovation Council,** which identified the need to link groups across the western provinces to leverage economic opportunities arising from the health system. The council's vision is to become a world leader in research by acting as an enabler in the innovation and productivity continuum from invention to commercial development. It has identified six areas for network prototypes: infectious diseases and immunology, functional foods, clinical research, medical imaging, medical devices and health services and systems. The National Microbiology Laboratory and the University of Manitoba are taking the lead in the Western Canada Infectious Disease Research Network, which could soon provide partnerships among academic, government and industry researchers under the council's umbrella.

Future projects, such as the two Manitoba initiatives described below, will help to build Canada's capabilities in the infectious diseases and life sciences sectors.

The new **Centre for Commercialization of Biomedical Technology** is a $12-million facility being established in conjunction with the NRC Institute for Biodiagnostics in Winnipeg. Scheduled to be built soon, it will focus on medical instruments and software, and offer support services to start and nourish new companies, including providing access to capital.

The **Centre for Imaging in Infectious Diseases** has been proposed by the National Microbiology Laboratory and the NRC Institute for Biodiagnostics to create a specialized area at the Canadian Science Centre for Human and Animal Health. The centre would study disease progression and potential treatments using state-of-the-art, non-invasive instrumentation, such as magnetic resonance imaging.

These organizations and proposals illustrate that positive initiatives are underway to establish pioneering programs and institutions to improve Canada's capability.

The International Centre for Infectious Diseases is meant to fill niches where the activities would benefit from a more co-ordinated and focused effort. It is becoming vitally important that the money governments spend on research, diagnosis and surveillance should be leveraged for its potential economic impact, so that maximum advantage is achieved from every dollar the taxpayer contributes. The International Centre for Infectious Diseases will bring together the best of what universities and government institutions provide, bridging them with the private sector.

The International Centre for Infectious Diseases will forge access to the largely untapped growth potential from technology commercialization by establishing links among the Canadian Science Centre for Human and Animal Health, public and academic institutions, and the private sector. Providing the process needed to transform government laboratory research into medical applications and disease prevention measures will be an essential core value of the new centre.

MANITOBA CAPABILITIES

Manitoba's comprehensive resources are apparent in the breadth and depth of its institutions and leading researchers dealing with infectious diseases and public health. Its physical resources, in terms of modern facilities and equipment, are unmatched in Canada. In human resource terms, Manitoba's infectious disease scientists, researchers and technical staff represent a core of the country's outstanding talent. Manitoba has one of the country's largest concentrations of clinical microbiologists, virologists, bacteriologists, parasitologists, epidemiologists and public health researchers, creating synergy in biomedical research, training and applications of research findings.

Manitoba's research expertise in medical microbiology and infectious diseases is reflected in its track record of excellence and innovation. Research accomplishments of eminent Manitoba scientists have had an enormous impact on global health and are saving thousands of lives annually. For instance, work being done in Africa by Winnipeg-based scientists has pioneered Canada's specialization in this field. With internationally recognized researchers and professionals in medicine, pediatrics and child health, medical microbiology and community health sciences, Manitoba is poised to become a leading entity in infectious disease research.

Education and training have been instrumental in supporting the infectious disease research effort and in building capacity for health care applications. Hundreds of scientists, students and medical fellows have received their training in Manitoba. The expertise of the University of Manitoba's departments of Medical Microbiology and Community Health Sciences was the basis for selecting Manitoba institutions and personnel to deliver a national training program, funded primarily by the Canadian Institutes of Health Research.

In terms of specialized infrastructure and institutions, Manitoba hosts a unique combination of universities, public health institutions, teaching hospitals and bioscience industry facilities that demonstrate an exceptional strength of talent and physical resources. This infrastructure includes the National Microbiology Laboratory and the

National Centre for Foreign Animal Disease at the Canadian Science Centre for Human and Animal Health. It also comprises the NRC Institute for Biodiagnostics whose 150 professional and technical staff work to increase prospects for prevention, earlier diagnosis, improved treatment and prognosis of diseases.

Manitoba Health's Public Health Branch monitors, identifies and addresses emerging health threats through its Cadham Provincial Laboratory (public health, reference and applied research), Communicable Disease Control Unit (identification, prevention, diagnosis and treatment) and Environmental Health Unit (responses to chemical, microbiological and environmental health problems). The province also has extensive epidemiology expertise and resources, such as its comprehensive administrative databases.

Other disease research institutions include the Manitoba Institute of Cell Biology (staff of 130 including 18 principal investigators in cancer and diseases like AIDS); Mammalian Functional Genomics Centre (human disease models); Manitoba Institute for Child Health (vaccination and mother-to-child HIV transmission); Health Sciences Centre (front-line infectious disease diagnosis and treatment); Canadian Blood Services (immune systems); Manitoba Centre for Health Policy (patterns of illness, vulnerability to disease); Manitoba Centre for Aboriginal Health Research (Aboriginal health); and Manitoba Centre for Proteomics (cell damage from viruses).

The NRC Institute for Biodiagnostics in Winnipeg, Canada specializes in non-invasive technologies for the treatment and prevention of diseases.

National and international collaboration is a hallmark of Manitoba's strategy. Its scientists are instrumental in alliances and partnerships across Canada and around the world. The following accomplishments reflect the leading role played by the National Microbiology Laboratory in Winnipeg:

- participation in the CDC's Laboratory Response Network, one of only three non-U.S. members
- chair of the WHO's Global Health Security Action Group laboratory network
- headquarters for the Canadian Public Health Laboratory Network, which focuses on bioterrorism, public health infrastructure, proficiency testing, training, reference services and disease surveillance
- integral part of the West Nile Virus Multi-Disciplinary Group, consisting of government agencies in health, conservation, environment and natural resources
- designation as the sole WHO Collaborating Centre on tuberculosis
- site of the National Centre for Foreign Animal Disease laboratory – the sole WHO Collaborating Centre on arboviruses and hemorrhagic fever viruses

Manitoba researchers and institutions are leading partners in multi-disciplinary research programs, such as the Canada-Kenya International Collaboration on Infectious Diseases Research and the World Bank and Canadian International Development Agency AIDS projects in India. Manitoba is also a member of the Canadian Network for Vaccines and Immunotherapeutics.

Commercialization is the last step in the continuum from laboratory to consumer. Licensing technology or creating companies brings new and innovative products to consumers. Manitoba currently has 37 companies in its, life sciences sector. Many of these companies utilize technologies developed in universities. Programs like Incubat help fledgling companies succeed. Incubat, a mentoring program for new start-up companies, provides early-stage management, business and fund-raising services. Located at Smartpark on the University of Manitoba's Fort Garry campus, Incubat provides new companies with access to university expertise, and exposes students to the biotechnology and information and communication technology sectors.

4.4 Community Benefit

First and foremost, Manitoba's outstanding capabilities in infectious disease research have had a positive impact on fulfilling national and international public health needs. At the same time, the cluster of associated institutions and companies has reaped significant economic benefits for the province. These benefits are visible in a wide range of areas, including investments in specialized facilities and equipment, creation of new, highly paid and skilled jobs, increased tax revenues, and expanded activity for suppliers of products and services throughout the economy.

An example of the economic impact is the work of Smith Carter Architects and Engineers Inc., which has built a flourishing international business based on its role in designing and building the Canadian Science Centre for Human and Animal Health. That experience permitted the firm to expand to the point where it is creating jobs in Winnipeg, and elsewhere, for new laboratory developments around the world. The company's projects include a new laboratory facility for the CDC in Atlanta, and another in Alberta for research and analysis of animal diseases.

The location of the Canadian Science Centre for Human and Animal Health in Winnipeg has brought substantial benefits to the community, and it continues to be one of the city's larger employers. However, it could become an even stronger economic growth engine as its research findings begin to spawn new products and businesses in Manitoba and across the country. The commercialization of discoveries from government laboratories offer brighter, longer term prospects for community economic development benefits – far beyond the initial construction and operation phases of the research facilities.

The International Centre for Infectious Diseases will forge access to the largely untapped growth potential from technology commercialization by establishing links among the Canadian Science Centre for Human and Animal Health, public and academic institutions, and the private sector. Providing the process needed to transform government laboratory research into medical applications and disease prevention measures will be an essential core value of the new centre.

5. NEEDS AND OPPORTUNITIES

Governments at virtually all levels have a role to play in dealing with the prevention, control and aftermath of infectious diseases. At the same time, future battles against infectious diseases will increasingly require joint efforts among international agencies, national governments, non-governmental organizations and the private sector, to bring the strengths of each into effectively halting and possibly eradicating diseases. (See – Building the Dream – inside back cover)

The International Centre for Infectious Diseases will spur further development of Manitoba's research institutions while providing new products for Canada's fight against infectious disease. This catalytic role will lead to business development and expansion of Winnipeg's cluster of infectious disease facilities. For example, the expansion of the pharmaceutical industry would benefit from being more closely linked to the research emerging from the National Microbiology Laboratory. The development of drug therapies for infectious diseases should take place nearby. Meanwhile, the pending development of a new faculty of pharmacy building near the Canadian Science Centre for Human and Animal Health will offer further opportunities for synergy.

Canada's public health system must be prepared to adopt new strategies, methods and tactics to fight diseases.

The business and industry sector plays a critical role by delivering the innovation that spells the difference between success and failure when addressing the challenges of infectious diseases. This innovation includes the conversion of basic research into tangible products such as vaccines and pharmaceuticals. Specifically, the development of new drug therapies and vaccines will be increasingly impor-

tant to the success of prevention, treatment and control programs.

Canada's public health system must be prepared to adopt new strategies, methods and tactics to fight diseases. Dealing with infectious diseases in the next decade will require the commitment of resources from governments, the volunteer community and the private sector. Extensive investment in new and advanced laboratory facilities and research staff is vital. Analytical and diagnostic capabilities must be expanded. As well, new drugs, vaccines and equipment must be invented to fight infectious diseases.

In many respects, Canada has been moving in the right direction towards fulfilling these needs. However, Canadians and Manitobans must be bold and take the steps necessary to deal with future infectious disease outbreaks that could endanger populations in this country and around the world.

- **Analytical laboratories** will increasingly be challenged to produce quicker results to deal with potentially lethal diseases. The construction and expansion of laboratories with high level (3 or 4) containment facilities has already begun to occur at a rapid pace, particularly in the United States. The capacity for quick response to outbreaks has increased, but there is an urgency to expand laboratory capacity and shorten the time spans for detection of epidemics.

- **Research laboratories,** working in conjunction with analytical functions, play an essential role in establishing the foundation for understanding diseases and providing effective measures to deal with them. Government infectious disease research laboratories have been traditionally oriented to serve other government and international agencies, and have had little incentive to pursue commercialization in partnerships with organizations outside the public sector. The result is a largely untapped potential for commercial applications.

Automation plays a key role in increasing the speed and volume of analytical testing, an important function of Winnipeg's National Microbiology Laboratory.

- **Pharmaceutical products** are essential tools in preventing and treating many infectious diseases. The pharmaceutical industry has shown exceptional innovation in providing products to treat a wide range of infectious diseases. Because the drug development process typically involves many years of research, testing and approvals, pharmaceutical companies must plan and invest for the long term. While their research traditionally has come from internal and university laboratory sources, many drug companies are looking more seriously at the possibility of partnering with government laboratories.

- **Vaccines** are crucial disease prevention and control products and have become a recent focus of attention for their potential use in countering the impacts of bioterrorism. The introduction of fast-acting vaccines has become a new development priority, as demonstrated by one new vaccine said to reduce the period to establish immunity from the Ebola virus from six months to four weeks. Historically, vaccines have been used solely to prevent diseases, but the benefits from shortening the time it takes to create immunity make these new vaccines appropriate for use during outbreaks.

Government and university laboratories have considerable scope for improving the ways they use their research to enable commercialization to occur.

- **The management of outbreak responses** is a vital but often overlooked capability that entails co-ordinating an assortment of medical, health care and government personnel and facilities, and establishing the control and communication systems needed to obtain and disseminate information and instructions.

- **Training and professional skills development** require long-term investments by government. A recent estimate forecast that by the year 2010, more than 10,000 new health researchers would be required to satisfy Canada's needs. This country's educational and training capability is exceptionally strong, presenting Canada with an opportunity to make this resource more readily available internationally.

- **Specialized services,** such as logistics, data and information management, and communication systems, are integral to the processes of dealing with infectious diseases. Canadians also have the capacity to support research and disease response systems through an array of ancillary services, as exemplified by Smith Carter's architectural expertise.

Terry Duguid, Co-Chair of the International Centre for Infectious Diseases Task Force.

- **New technologies** to deal with bioterrorism are increasingly being sought to fulfil the demand for rapid detection. In many cases, this involves having equipment that is portable enough to be carried by first responders or to be deployed internationally. These needs demand a considerable investment in new technologies and sophisticated equipment. New Canadian products, like those emerging from Winnipeg's NRC Institute for Biodiagnostics, illustrate how research can be transformed into products with extensive benefits to the community.

- **Technology transfer** is an area that has not received the degree of attention and support it deserves. This involves taking the research through the development process and into the creation of new products and innovative services. Government and university laboratories have considerable scope for improving the ways they use their research to enable commercialization to occur.

The International Centre for Infectious Diseases could have an important impact on each of the areas outlined above, either through its own activities or in its role as facilitator for researchers, health care institutions and companies involved in infectious disease products or services. The above areas should also be the focus of our efforts to establish or attract business ventures related to the work taking place at the Canadian Science Centre for Human and Animal Health and the International Centre for Infectious Diseases.

UNIVERSITY INTELLECTUAL PROPERTY

Turning creativity and research findings into new ideas and products generates intellectual property, which takes the form of assets such as patents, copyrights and trademarks. Universities provide an array of valuable support services and facilities to support this process.

The University of Manitoba provides an example of the process. Its new team, Intellectual Property Advice and Technology Assessment Services, deals with inventions and works with researchers to investigate their discoveries for marketing potential, patentability and ownership rights. The team also charts milestones for future product development.

The Commercialization Assessment Group then draws on the business community for guidance on patent and commercialization strategies for the ideas and inventions. This group looks at business opportunities and recommends development paths for licensing or potential spin-offs. The university's LicensePro program involves looking for licensees, negotiating terms, generating legal paperwork, collecting payment and distributing royalties.

VentureBox is the vehicle for technologies with the potential to generate a spin-off company within 18 months. Its services include incorporation, workshops for researchers, marketing and promotion, business and research planning, first-year funding for patent costs, and business advice. The $4-million Springboard Fund provides financial support for proof-of-concept to help companies attract traditional venture capital financing.

The University of Manitoba's Smartpark is home to Incubat, a technology business incubator that offers critically needed management, business, and financing expertise to early-stage life sciences and information and communication technology companies. Incubat serves firms from within and outside the university, providing hands-on operational support and management, along with access to equipment, infrastructure and physical space, as needed.

6. ISSUES AND CHALLENGES

Based on task force discussions and research, some important observations have emerged about the current situation and the requirements to strengthen Canada's infectious disease capability – particularly in Manitoba. The following issues and challenges are focused on Manitoba, and are in line with our mandate to identify how economic and community development opportunities can be pursued for a Winnipeg cluster of health and life sciences research, academic and industry organizations involved in infectious diseases. We have identified six key areas that warrant further attention surrounding future investment and activity for the International Centre for Infectious Diseases.

The first is fostering greater **capacity** across Canada by building on our strengths and establishing the right institutional structure. This includes ensuring the necessary levels of readiness and resources when infectious disease outbreaks, from whatever sources, strain Canada's capabilities to respond.

The second is more **research.** Without it, we will be unable to achieve comprehensive and preventive solutions to deal with infectious diseases and Canada will face even higher future costs in constant crisis responses.

The third is ongoing investments in **cluster development** – facilities, infrastructure and marketing – specifically research laboratories, educational funding resources, and information and monitoring systems, which are necessary to prevent and deal with future disease conditions.

The fourth is quality **human resources** to ensure the availability and retention of professional, technical and management personnel, who can contribute their expertise to infectious disease research.

The fifth is **networking and collaboration** that encourage sharing of resources and making the best use of skills, talent and facilities, wherever they may be located.

The sixth is **technology transfer,** or converting research findings into practical applications and, in some cases, commercial products and services.

Canadian scientists and medical personnel are making an extraordinary contribution in the fight against infectious diseases around the world.

6.1 Capacity

The first key challenge to fostering greater capacity across Canada must include ensuring the readiness and resources when infectious disease outbreaks strain our capabilities to respond. Canadian scientists and medical personnel are making an extraordinary contribution in the fight against infectious diseases around the world. A re-organization of Canada's institutional structure, in the wake of the recent SARS incident, provides an opportune time for the International Centre for Infectious Diseases to define its role within a more effective national system. The conclusions of the Naylor Committee create an opportunity to establish a more coherent and effective institutional structure. This should involve making full use of the country's human and physical resources, and pursuing a development strategy that is beneficial to Canada.

- The task force endorses the approach taken by the Naylor Committee and Health Minister Anne McLellan to establish more co-ordination and reinforce national leadership to deal with infectious disease outbreaks.

Canada's expertise in infectious disease detection, analysis and prevention includes its capabilities in epidemiology, the study of the cause and distribution of disease. Drawing on data, reports and information collected from various sources, epidemiology provides a perspective on underlying trends and connections between causal factors in infectious diseases. It identifies patterns of disease in populations, which can point to an impending outbreak

and its source. Capabilities in epidemiology extend across Canadian government institutions – at the national level, they are based in Health Canada's Centre for Infectious Disease Prevention and Control in Ottawa.

The work performed by epidemiologists at the Winnipeg Regional Health Authority and Manitoba Health has become integrated into public health programs. Manitoba Health's extensive epidemiology databases provide a valuable resource for disease management, but further co-ordination is needed to improve this essential function. The linking of laboratory and epidemiology research has proven to be one of the most significant contributors to the strength of the U.S. Centers for Disease Control and Prevention.

The task force:

- sees great value in adding more epidemiology funding resources and personnel within the National Microbiology Laboratory in Winnipeg to enable faster data analysis and more effective targeting of problem areas where further testing can yield valuable results; and

- supports the establishment of a Manitoba epidemiology network, which would help connect medical researchers and national laboratories, enabling them to take greater advantage of Manitoba Health's extensive databases.

The reinforcement of Canada's leading role in infectious disease research requires an effort to attract the best and brightest researchers from around the world. While the National Microbiology Laboratory has been successful in doing this, further incentives are needed to ensure Canada's capacity is sufficient in future crises. The experience of the Georgia Research Alliance, through its Eminent Scholars program, has shown that it is possible to attract renowned scientists whose work and findings generate tremendous economic benefits. The Georgia Research Alliance enables universities and institutes to obtain the resources to recruit scientists from other parts of the world, who bring their innovative research programs and staff with them. They have proven to be catalysts in creating several start-up companies based on their research and consequent commercialization of technologies.

- The task force supports a new, distinguished researcher program, acting in conjunction with Manitoba's universities and the International Centre for Infectious Diseases, to help the province attract and cultivate a new generation of renowned infectious disease scientists.

John Rutherford, a research technician, works in an HIV laboratory at the University of Manitoba's department of Medical Microbiology.

6.2 Research

The second key area is more research. Without a firm commitment to substantially increase fundamental research that leads to comprehensive and preventive solutions, Canada will only face higher future costs in repeated crisis responses. Canadians are gradually becoming aware of a fact that governments have known for many years – investment in infectious disease research during the past two decades has yielded exceptionally valuable and cost-effective results for preventing and managing disease outbreaks. Coping in outbreak situations after the fact has proven to be far more expensive, and research investment is essential to improve Canada's response capability.

Even before the Naylor Committee report was issued, the federal and provincial governments concluded that more investment in public health research capacity was a priority. It will enhance Canada's ability to cope with emerging and re-emerging infectious disease outbreaks. Innovation will lead to new treatments and preventive methods and therapies that will, in turn, help the world improve its public health performance. The work of the International Centre for Infectious Diseases in pursuing visible results and commercial opportunities will help demonstrate, in more tangible terms, the value of the country's further investment in infectious disease research.

- The task force encourages greater Canadian and Manitoba government investment in infectious disease research to help improve Canada's response capability.

Without a firm commitment to substantially increase fundamental research that leads to comprehensive and preventive solutions, Canada will only face higher future costs in repeated crisis responses.

Funding for infectious disease research in Canada has been primarily a function of governments, with some resources from private sector and charitable organizations devoted to disease treatment. There have been few efforts to develop new sources of funding for infectious disease research, apart from some funding support for related medical education. Meanwhile, the experience of the CDC Foundation in the United States and the Educational Foundation of the Pan American Health Organization, in raising funds through corporate and individual charitable contributions, shows the potential that exists. Funds raised last year by the CDC Foundation are going primarily into projects, professional development and public education. This funding supports relatively low-budget activities that can have a visible impact on encouraging healthy lifestyles, preventing disease and generating public understanding.

- The task force endorses charitable contributions, corporate sponsorships and foundation support as potential sources of funds to support infectious disease research, training and education.

The National Centre for Foreign Animal Disease operates within the Canadian Food Inspection Agency's mandate to enforce food safety and nutritional quality standards. Its broad mandate and operational focus leave little funding for research. This situation has inhibited the establishment of joint research programs with the National Microbiology Laboratory. Given the worldwide convergence of human and animal health research, increased collaboration between the National Microbiology Laboratory and the National Centre for Foreign Animal Disease will be vital to address emerging infectious diseases.

- The task force believes that integrating the two laboratories within the Canadian Science Centre for Human and Animal Health could create exceptional advantages in cost efficiencies and synergies for scientific advancement.

6.3 Cluster Development

Clusters of similar, related or complementary organizations, in a geographically defined area, have become the new basis for community development strategies. Clusters generally face similar opportunities and threats, and share infrastructure, labour markets and services. In Manitoba, these are the building blocks for the infectious disease cluster. The vision and leadership are emerging in Manitoba, as are the institutions required to support the next phase of development.

Manitoba's infectious disease cluster is located primarily in the vicinity of the University of Manitoba's research and medical facilities, and the Canadian Science Centre for Human and Animal Health. In its

entirety it is more widely dispersed, encompassing health facilities and life sciences organizations within the broader Winnipeg region.

Cluster development requires the creation of close relationships among institutions of all kinds, both public and private sector. Effective clusters require creative mechanisms to link diverse institutions that otherwise tend to operate in isolation. Organizations like industry and professional associations and universities provide the sense of community and commonality, which connects people and institutions.

Clusters of similar, related or complementary organizations, in a geographically defined area, have become the new basis for community development strategies.

The cluster concept also recognizes the importance of physical proximity. Clusters involve sharing and joint activities, as well as networking in professional and informal settings. Personal and professional contacts should be encouraged by establishing joint meeting facilities, industry-wide organizations, professional development events, social occasions and other activities that encourage contact with one another. The nature of a campus setting is integral to cluster development.

New facilities and infrastructure will be necessary for success of the new infectious diseases cluster. Expanding scientific programs at the Canadian Science Centre for Human and Animal Health will soon require more biocontainment laboratories and administrative facilities. Furthermore, the expansion of activity around the laboratory and the University of Manitoba medical school campus will require new research and administrative space.

The University of Manitoba's downtown campus is a key component of Winnipeg's growing infectious disease cluster.

The Canada and Manitoba governments should work together with the academic and private sectors to develop a long-term plan to further expand the infectious disease infrastructure around the site.

Cluster building in Manitoba also involves promoting and marketing Winnipeg's exceptional capabilities and strengths in infectious disease research, an important segment of the city's rapidly growing biotechnology and life sciences sector. A variety of factors – existing world-class facilities, current investments, leading scientists and researchers, available land for expansion, a well–developed international network with the CDC and other organizations, a central location, a growing biotech and life sciences sector and competitive business costs – combine to make Winnipeg a logical choice, from a business and taxpayer perspective, for expanding activity in infectious disease research.

The value of the International Centre for Infectious Diseases is that it offers a way for government and public institutions to interact with the private sector without jeopardizing their independence or losing their concentration on basic research and analysis.

- The task force sees the International Centre for Infectious Diseases working in conjunction with companies, universities, government research facilities and other public institutions to develop cost-effective solutions to facilities and infrastructure opportunities that would be difficult and costly to develop alone.

The National Microbiology Laboratory has been able to recruit exceptional personnel from other countries, competing for talent with institutions around the world.

The task force has noted the value and attractiveness of Manitoba as a location for new companies and production sites. This asset could be highlighted and marketed on the basis of its uniqueness and strength. For example, a recent KPMG study showed that Winnipeg has significant cost advantages relative to other cities involved in biomedical research and development. The industrial and community development opportunities in the infectious disease cluster encompass research and analytical laboratories, pharmaceuticals, vaccines, outbreak management systems, professional education and training, and specialized services such as logistics and information services.

The cluster's proximity to universities and government institutions is potentially beneficial. At the same time, it is critical that the strategies to attract companies in this field emphasize the receptiveness of university and government laboratory personnel to work in partnerships. Sheer proximity is not enough – a sense of teamwork and openness to partnering is also crucial. The physical assets of land in the Manitoba infectious disease cluster are considerable, given the potential availability of sites. It will be important to create a clear plan and process to develop the region so that the infectious disease cluster will be encouraged to grow and thrive.

- The task force recognizes that marketing the land adjacent to the Canadian Science Centre for Human and Animal Health, and establishing a closely linked group of institutions and companies in this area in the coming years, will be crucial to the success of the Manitoba infectious disease cluster.

6.4 Human Resources

The fourth key area is education and training. Investment in this area will ensure the availability and retention of professional, technical and management personnel needed to achieve the International Centre for Infectious Diseases vision. The federal government laboratories in Manitoba have not had problems in attracting professionals in infectious disease disciplines. The National Microbiology Laboratory has been able to recruit exceptional personnel from other countries, competing for talent with institutions around the world. Links with University of Manitoba staff have enabled its researchers to gain access to grant funding and graduate student assistance, as well as exceptional physical facilities and equipment.

However, retaining researchers in Manitoba and other Canadian locations will be increasingly difficult in the face of growing overall shortages of highly skilled researchers and medical personnel. The new Level 4 biocontainment facilities being built in the United States will soon lure researchers from Canada. Retaining the top people will become more difficult as other nations continue to invest substantially in infectious disease research in their universities and government facilities. Staff retention in public institutions is challenging due to personnel systems and limits on remuneration. World class researchers are highly marketable. Therefore, creative ways are needed to retain them.

Providing exciting research opportunities is an important strategy in recruiting and retaining scientists in Manitoba.

The ability to engage in novel and innovative research is crucial. Financial constraints at the

Training is a central component of Winnipeg's National Microbiology Laboratory, run by world-renowned scientist Dr. Frank Plummer.

National Centre for Foreign Animal Disease, for instance, led to a shortage of laboratory technicians, resulting in the assignment of research staff to perform basic BSE diagnostic testing, instead of focusing on research. The ultimate outcome of this kind of situation is the imminent loss of staff who are highly prized experts in their disciplines. Governments in Canada are restricted by their inability to meet some of the basic needs of specialized researchers, especially those working in infectious diseases, who are mobile and increasingly in demand. Providing exciting research opportunities is an important strategy in recruiting and retaining scientists in Manitoba.

- The task force recognizes that retaining infectious disease researchers within Canada must be addressed by creating innovative ways to provide them with interesting assignments, additional remuneration and project support while enabling them to focus on their primary government research functions.

Training provided for Canadian and foreign students by the National Microbiology Laboratory and the National Centre for Foreign Animal Disease is currently done without pricing or cost recovery. Their professional courses are made available to specialists, MDs, lab personnel, as well as responders and teams involved in crisis management. Government institutions lack incentives for cost recovery because of the policies that require the funds to be returned to general revenue.

Training is a valuable Canadian resource and potential revenue generator that could provide an incentive for its provision in the future. An institution or mechanism outside the federal government system could offer a means to channel the revenue earned from training into infectious disease research and development. As a result, researchers, and those involved in providing the training, would be able to make use of the revenue to strengthen Canada's research base.

- The task force believes a fee-based training program in infectious diseases, established through the International Centre for Infectious Diseases in association with government laboratory personnel and facilities, could enable the revenue generated by training to go to infectious disease research and public health projects.

Canadian graduate studies and other educational programs exist in public health management, but few provide the specialized tools and expertise needed for managers in the infectious disease field. American universities have accredited masters degree programs in public health that teach skills related to infectious diseases in their study programs. These skills include assessing and monitoring health in communities, formulating public policies, assuring access to care, promoting health, preventing disease and evaluating the provision of health care. Programs of this kind are located in various parts of the country and their co-ordination should be explored further.

- The task force suggests that the Government of Canada work with Canadian universities to identify ways to establish a masters in public health program with an infectious disease specialization, possibly involving a joint program among universities to take advantage of each facility's specialized expertise.

Biosafety is a field with great potential demand for training. There are currently no formal training programs in this field. Researchers at the Canadian Science Centre for Human and Animal Health have experience in providing this sort of training and have obvious expertise in the field. This presents an opportunity to establish a comprehensive Canadian educational or certification program in biosafety theory or practice that would be attractive to both domestic and international students.

- The task force suggests the Canadian Science Centre for Human and Animal Health, the University of Manitoba, and other institutions develop a national training program in biosafety.

Bioinformatics, the science of processing biological data for storage and retrieval, has become an integral tool for researchers, epidemiologists and disease outbreak managers dealing with infectious diseases. While there is some bioinformatics training in Canada, Manitoba offers no programs at the level needed for rigorous scientific research applications. The University of Manitoba is considering a program in this field, but it is not yet at the development stage. Bioinformatics is a relatively new area of study and practice that is growing, and will continue to do so, as technology improves. The ability to analyze large amounts of information quickly and accurately is particularly important in the fields of genomics and proteomics.

- The task force believes a program in bioinformatics, at the university undergraduate and/or graduate level, would fill an emerging and vital skills requirement to support infectious disease outbreak response for Manitoba and Canada.

MANITOBA'S INFECTIOUS DISEASES CLUSTER

The government and university research institutions working on infectious diseases have generated valuable business activity and employment in several sectors of the economy.

- **Cangene Corporation, a Manitoba-based company producing hyperimmune products and vaccines, provides an excellent example of research commercialization. It has more than 500 employees and exports to 35 countries. Its first product involved a technology discovered by two University of Manitoba scientists. Since then, Cangene has experienced dramatic growth. Its product line has expanded to include treatments for hepatitis and other infectious diseases. The firm now works with the CDC in Atlanta, supplying the U.S. biodefence initiative with vaccine and hyperimmune products that act as countermeasures to anthrax, smallpox and botulism toxin. Cangene is collaborating with the Canadian Science Centre for Human and Animal Health to develop hyperimmune products for West Nile, SARS, Ebola and Marburg viruses.**
- **Smith Carter Architects and Engineers Inc. is building the world's laboratory infrastructure for infectious disease research. The Manitoba-based firm has created one-stop-shopping in an integrated architectural practice based on expertise in high-technology containment facilities for research and health care institutions. They started with the Canadian Science Centre for Human and Animal Health and are presently working on more than 20 international projects. These new projects create professional and technical jobs in Manitoba in several related fields. Its staff serve as specialized consultants, from their Winnipeg base, in laboratory projects around the world and participate in joint ventures for research centres being built in several countries.**

These examples are indicative of the exceptional combination of facilities, research institutions, skilled infectious disease professionals, highly trained technical support staff and associated business development that exist in Manitoba's cluster. The province offers valuable business prospects to new and relocating companies through advantages like receptive research partners, available land for expansion, a central location and competitive costs. The attractive business climate in Manitoba's life sciences and infectious diseases cluster offers opportunities for growth and enhancement.

6.5 Networking and Collaboration

The fifth challenge involves networking and co-operation, which entails the sharing of resources and making the best use of skills, talent and facilities, wherever they may be located. Research networks are being formed to link researchers from around the world who work in infectious diseases, enabling them to share information, data and findings. These networks have begun to prove their value, especially in disease outbreak situations that require quick responses. Their potential should be tapped in ways that maximize their use as resources for both disease prevention and crisis management.

Opportunities should be created to build relationships among researchers and establish a greater sense of community from within.

Researchers in infectious diseases should be acknowledged for their contributions to their professions and to the community. In many respects, the recognition they receive comes primarily from their peers or colleagues in other parts of the country or the world. Their sense of affiliation is mainly with their professional colleagues, rather than their local community. As a result, researchers tend to be highly mobile. Opportunities should be created to build relationships among researchers and establish a greater sense of community from within. This could help in our efforts to retain researchers. This is not to suggest creating an industry association, but rather, encouraging local networking and contacts beyond the immediate institutions and facilities where the researchers work. Organizations like the Georgia BioMedical Partnership have demonstrated how facilitating this kind of contact helps create a sense of personal affiliation within a cluster and community that contributes to both professional and career development.

- The task force suggests forming a networking group in infectious diseases and biomedical sciences that spans the cross-section of medical professionals, researchers, managers and technologists in related public and private-sector organizations throughout Manitoba.

There are parallels between Georgia's experience with the CDC and Manitoba's experience with the Canadian Science Centre for Human and Animal Health. The existing technical links between the National Microbiology Laboratory in Manitoba and the U.S. Centers for Disease Control in Atlanta have proven valuable for both institutions and should be expanded. The exchanges of research and scientific personnel in recent years have reinforced the considerable strengths and specializations that each institution has established. Examples of business development between the two locations are Smith Carter's laboratory project for the CDC in Atlanta and the business activities of Cangene Corporation in the state.

Both jurisdictions have significant agribusiness, manufacturing and life sciences sectors, as well as similarities in their rural-urban population structures. The possibility of collaboration between the two governments on infectious disease research and commercialization should be pursued, particularly to enable technology transfer and build complementary capabilities and development strategies.

- The task force sees the value in potential business and research connections between the Province of Manitoba and the State of Georgia, based on a common interest in cluster development around infectious disease research, educational facilities and business.

6.6 Technology Transfer

The sixth key area is technology transfer, which entails converting research findings into practical applications and, in some cases, commercial products and services. It is no longer enough to invest in research and health care initiatives without leveraging those funds for economic development. Canada's huge investments in health care, particularly related to fighting infectious diseases, could be re-oriented to have a far more significant impact on employment, community development and wealth generation. Too often, health care has been perceived simply as a cost to bear, rather than an activity that can generate new economic development and opportunities. A purposeful approach to investment and applied research must be made for economic development benefits to flow with greater frequency. This involves drawing from the creative pool of research and entrepreneurial innovation that drives economic growth in our knowledge-based economy.

Government laboratories have traditionally faced severe constraints in working with the private sector on technology transfer and in taking greater advantage of research discoveries. While these laboratories have been excellent producers of research results that have improved the health of Canadians, they have not generally encouraged commercialization of their work.

For the most part, government facilities like the National Microbiology Laboratory cannot become directly involved in many aspects of technology transfer or commercialization. They have a mission to perform, and should focus their energies on what they do well and what they can best contribute. There are other ways that the researchers in government facilities, and their findings and discoveries, can play a greater role in economic development. Other independent institutions and not-for-profit organizations, such as the International Centre for Infectious Diseases, could work with government researchers and the private sector to facilitate technology transfer.

- The task force believes that establishing innovative institutions that facilitate the commercialization and application of findings (while permitting researchers to focus on their work), would improve Canada's capacity to tap into government's infectious disease research for technology transfer purposes.

Shortages of trained professionals and technical specialists exist across Canada, especially in biotechnology business management and technology transfer. Business management related to biotechnology and infectious diseases requires skills in many areas, including regulatory affairs, marketing, clinical trial management, intellectual property protection, financing, mergers and acquisitions, and negotiation of licensing agreements. There are

Smartpark encourages interaction between businesses and researchers to promote technology transfer, the commercialization of leading-edge research.

relatively few people within Canadian governments, universities or companies, with this combination of skills. Because the commercialization of government research is comparatively new, there are few people with experience or notable track records.

Too often, health care has been perceived simply as a cost to bear, rather than an activity that can spawn new economic development and opportunities.

In a broader sense, there is a shortage of qualified personnel who understand both business and science. There is a gap in technology transfer management education for entrepreneurs, resulting in too few research findings becoming commercialized. Courses geared to the business interests of scientists are not readily available – with the notable exception of the Westlink Internship Program – and there is little cross-training to help them expand their understanding of technology transfer. Similarly, few opportunities exist for business students to gain an understanding of science and its potential for commercialization.

The commercialization of research requires a skill set that has not yet been developed fully in Canada. Universities and colleges have recognized the problem and are starting to respond. The University of Manitoba has an intellectual property management certificate program in the development stage that may bridge this gap by concentrating on the unique problems and issues encountered by managers in technology and research spin-off companies. The University of Western Ontario has a masters in business administration program with a concentration in biotechnology. The Health Care Products Association of Manitoba has developed valuable and productive courses addressing management and other topics for their corporate members. Still, more is required to build Canada's capability to make greater use of the research in infectious diseases and other fields.

- The task force recognizes the need to establish innovative business studies programs at the graduate and undergraduate levels, and certificate programs in commercialization and intellectual property management.

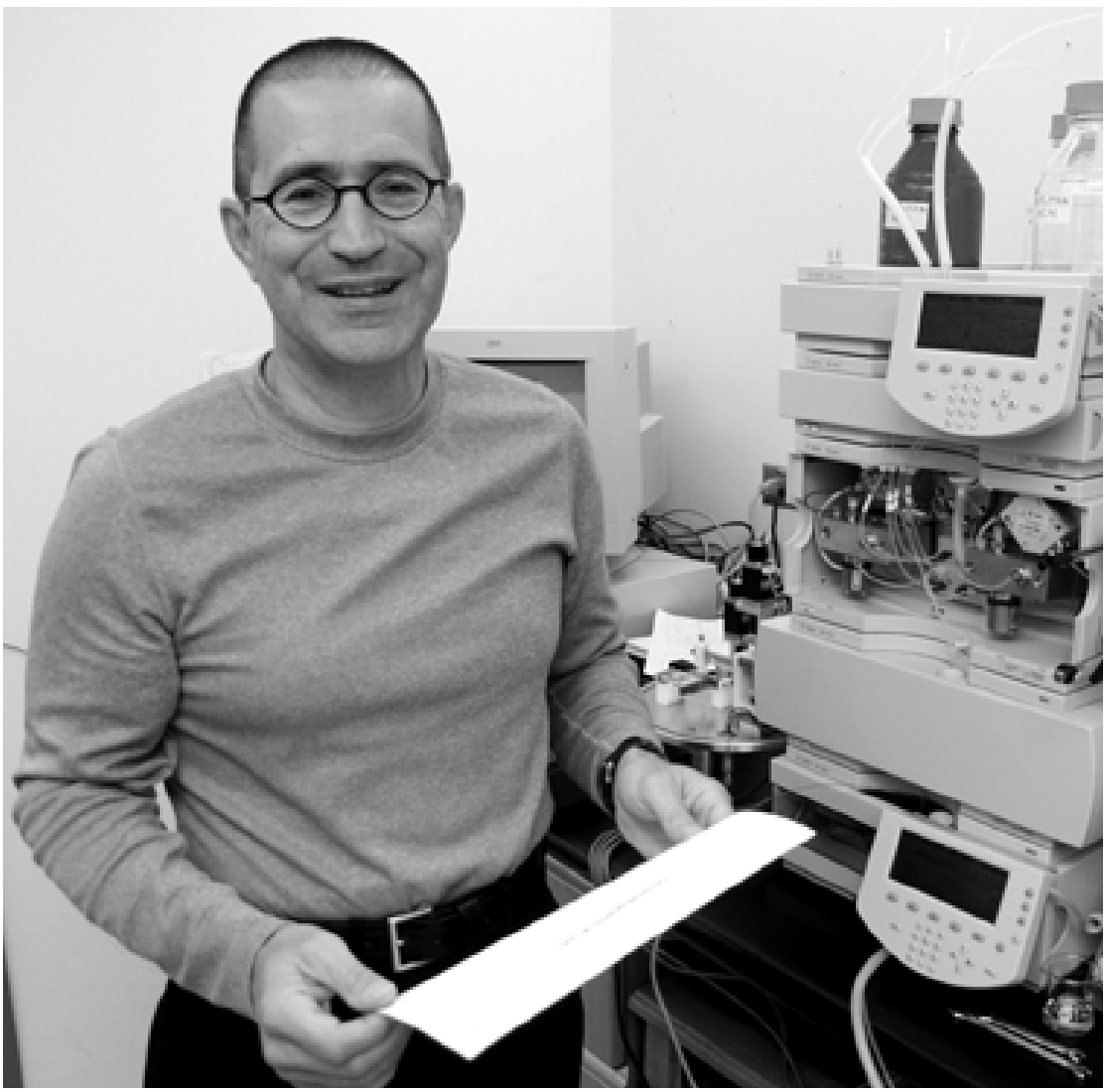
The strategy to fight infectious diseases cannot be pursued in isolation. It should be consistent with the notion of seeking a return on Canada's investment in the broadest terms – not simply in public health consequences. The risks and potential rewards involved in commercialization, and the skills and management to enable technology transfer, have gained more attention from universities than from governments. Changing attitudes in those academic institutions are encouraging innovation in infectious disease research. One startling fact remains – universities have been the basis for most of the remarkable growth in biotechnology, and for the establishment and success of bioscience companies, including those in infectious diseases. The pivotal role of universities is consistent in all of the major biotechnology clusters in North America, including Manitoba. It is the universities that have introduced measures to assist researchers in converting their creativity and discoveries into products and assets. They have built an infrastructure of services and facilities that enable intellectual property to be evaluated and applied.

By contrast, scientific researchers working in government laboratories rarely have the resources to help them deal with matters involving technology transfer or commercialization. Those employed in government institutions, for instance, often lack information about how to proceed. Government research institutions tend to be focused on immediate tasks and do not assign sufficient resources to do the required liaison, intellectual property development and commercialization. While the National Microbiology Laboratory has been innovative recently in its patents and liaison effort, there are simply not enough financial and support staff resources to establish a comprehensive technology transfer and commercialization process.

One startling fact remains – universities have been the basis for most of the remarkable growth in biotechnology, and for the establishment and success of bioscience companies, including those in infectious diseases.

There is an apparent need in government research facilities, specifically the Canadian Science Centre for Human and Animal Health, to educate researchers about technology transfer, develop licensing opportunities for government research facilities and researchers, co-ordinate contract research and consulting opportunities and provide business services for commercialization processes.

- The task force believes that given the current lack of support and resources for researchers in government laboratories to pursue commercialization and technology transfer, a source of assistance and advice is warranted.



Dr. John Wilkins is co-director of the Manitoba Centre for Proteomics at the University of Manitoba.

7. RECOMMENDATIONS

The findings of the task force point to the need to establish more co-ordinated and effective Canadian responses to the threat of infectious diseases. In keeping with the task force's mandate, the recommendations in this report are focused on identifying economic and community development opportunities related to Manitoba's growing cluster of health and life sciences, academic and industry organizations involved in infectious disease research.

Proceeding with these initiatives now will have a positive impact on national and provincial public health outcomes and, therefore, should receive significant support by Health Canada and Manitoba Health.

Our recommendations, however, also speak directly to the long-term value of improvements in Canada's public health system through investments in research, training and infrastructure. Proceeding with these initiatives now will have a positive impact on national and provincial public health outcomes and, therefore, should receive significant support by Health Canada and Manitoba Health.

The task force recommends the establishment of new institutions and functions within the framework of an International Centre for Infectious Diseases, with the architecture of that organization designed to enable Manitoba to maximize its contribution to Canada's infectious disease effort.

We also recommend a community development project – BioMed City – and other initiatives by governments and academic institutions that will enable the International Centre for Infectious Diseases to fit seamlessly into a comprehensive cluster strategy.

A technician at the NRC Institute for Biodiagnostics, located in Winnipeg, Canada, uses non-invasive technology to monitor changes in brain matter caused by BSE.

The International Centre for Infectious Diseases should have a robust institutional form and complement existing organizations and institutions. It should operate on a considerably larger scale and with more ambitious objectives than anticipated four years ago. Its establishment would mark a significant departure from the ways in which infectious disease research and associated activities have been developed thus far in Canada. It is our recommendation that, to fulfil its mission, the International Centre for Infectious Diseases should have the following attributes:

- be a national not-for-profit incorporated entity
- be research-driven and innovation oriented
- have effective governance and decision-making capabilities
- be sufficiently funded and empowered to earn and use income
- have the organizational capability to attract and retain the best and the brightest
- have extensive links to academic and private sector institutions, forming alliances and partnerships with other Canadian and international entities

The task force recommends that the attributes outlined above be achieved with the following four organizational elements under the umbrella of the International Centre for Infectious Diseases:

- research capability – the ICID Research Institute
- training capability – the ICID Training Program
- commercialization capability – the ICID Innovation Facility
- fund-raising capability – the ICID Charitable Foundation

The International Centre for Infectious Diseases should be an entity in its own right. Its corporate form, governance structure and sources of funding are crucial. Its success will depend on extensive co-operation with government and academic institutions. However, it cannot simply be a partnership, or organization, operating under the control of stakeholders representing other organizations.

The International Centre for Infectious Diseases should embrace the transition towards a new organizational culture of shared values and beliefs. It should represent a new type of organization, which interacts productively with universities and government institutions while maintaining the flexibility to pursue its own mandate and objectives. The centre would perform functions that existing organizations, particularly those in the Canadian Science Centre for Human and Animal Health, are constrained from carrying out.

Staff and participants in the ICID Research Institute would come from environments that include universities, industry and government, to promote innovative thinking and cross-discipline collaboration.

The four organizational elements within the International Centre for Infectious Diseases are mutually reinforcing and essential for the achievement of the organization's overall mandate.

7.1 ICID Research Institute

The task force recommends the establishment of the ICID Research Institute as the lynchpin of the International Centre for Infectious Diseases. It would conduct contract research, carry out scientific and analytical projects, foster collaboration among scientists, and provide mentoring for young scientists and professionals in the infectious disease field. The institute would act as the conduit for infectious disease research, soliciting and carrying out contracted research and earning revenues from its research, consulting and training activities.

Staff and participants in the ICID Research Institute would come from environments that include universities, industry and government, to promote innovative thinking and cross-discipline collaboration. Their backgrounds may involve research, consulting or training in bioinformatics, biosafety, public health, primary care medicine, Aboriginal health, genetics, epidemiology, management, vaccines, biomedical engineering, or human and

animal infectious diseases. Through its university affiliations, the ICID Research Institute would facilitate training for Canadian and overseas students, including graduate students and medical and post-doctoral fellows.

A specific initiative would be the establishment of five research chairs in infectious disease disciplines to create a distinguished researcher program and advance Canada's pre-eminence in infectious disease capability. This initiative would involve having the International Centre for Infectious Diseases serve as the co-ordinating institution, and enable the five research chairs to work in conjunction with Canadian academic institutions.

The task force identified the following issues and challenges to be addressed by the ICID Research Institute:

- co-ordination of infectious disease research and projects across existing government and academic institutions
- options for generating additional income sources from contracted research and consulting projects, which could supplement government compensation and project funding levels and counter the lure of alternative laboratory assignments in the United States and elsewhere
- conditions to encourage the recruitment of prominent scientific researchers to Canada and Manitoba
- collaboration between the National Microbiology Laboratory and the National Centre for Foreign Animal Disease through integrated research projects and laboratory activity

7.2 ICID Training Program

The task force recommends the creation of the ICID Training Program, to lead the marketing and delivery of training and instructional courses to Canadian and international organizations and students, in conjunction with government laboratories and academic institutions. The institute would be involved in enabling course development, veterinary infectious disease certification, post-doctoral fellowships, and international exchanges for researchers and medical doctors, as well as new training initiatives in bioterrorism, biosafety, public health, commercialization, and technology entrepreneurship.

Training related to infectious diseases is in significant demand domestically and throughout the world, and should be offered through this program on a cost recovery basis or as a revenue-generating source. The current provision of domestic and foreign training at no charge to students or their employers through the government infectious disease laboratories is not sustainable.

The task force noted that the ICID Training Program could play a role in the existing training program already awarded to the International Centre for Infectious Diseases through the University of Manitoba, by the Canadian Institutes for Health Research. That program currently involves the laboratories at the Canadian Science Centre for Human and Animal Health and the University of Manitoba and consists of a curriculum, trans-disciplinary research practica, and formal and informal scientific interactions.

The ICID Training Program would enable the federal laboratories to begin to achieve a form of cost recovery for their services. In conjunction with the ICID Research Institute, it could also overcome the current restrictions that prohibit Health Canada researchers from accepting other compensation in exchange for their expertise. The program should initially involve the scientists, managers and specialists throughout Manitoba's infectious diseases cluster, helping them to adopt a comprehensive edu-

cational and training focus. It should be designed to build on the common interests and professional development objectives of researchers, entrepreneurs and governments, and be extended to include information sharing, seminars and guest speakers.

The ICID Innovation Facility would serve as a technology application and business development incubator, modelled after the new Centre for Commercialization of Biomedical Technology being developed at the NRC Institute of Biodiagnostics in Winnipeg.

Community organizations would be valuable resources to help develop and deliver the training programs, in addition to the Health Care Products Association of Manitoba and the University of Manitoba. Leveraging the local expertise at the University of Manitoba (including the Asper Centre for Entrepreneurship), Health Canada, and Red River College, among others, would be cost-effective and make use of Manitoba's current assets.

Assistant professor Dr. Keith Fowke researches existing and emerging diseases at the University of Manitoba's department of Medical Microbiology.

7.3 ICID Innovation Facility

The task force recommends the development of an ICID Innovation Facility, to be a service provider and business incubator that operates within the International Centre for Infectious Diseases. Its personnel would work with researchers in infectious diseases and life sciences to enable them to succeed in technology transfer and business creation.

The ICID Innovation Facility would be involved with researchers to co-ordinate contract research, facilitate researchers' consulting assignments and bring inventions to market through licensing, spin-off companies and partnering. It would enable the applied research from the ICID Research Institute to be directed into commercial uses and develop revenue streams. The facility would educate and coach researchers about commercialization options, as well as build relationships between researchers and potential licensees. It would be a useful resource for government laboratory scientists, who would not otherwise have access to this kind of expertise and assistance.

The ICID Innovation Facility would serve as a technology application and business development incubator, modelled after the new Centre for Commercialization of Biomedical Technology being developed at the NRC Institute of Biodiagnostics in Winnipeg. It would provide advice and business services such as legal, patenting, accounting, and marketing, and help experienced managers become involved in company development to provide counsel and enable continuity in organizational growth. This facility would deal with marketing intellectual property – a vitally important factor in helping new products reach their markets – as well as protecting the rights of intellectual property owners.

The new facility could provide merchandising services for inventions that originate at the ICID Research Institute.

Existing private and public institutions could play pivotal roles in the delivery of incubator services. In some instances, the University of Manitoba, or other organizations, could deliver the services or provide the facilities. This would prevent any potential duplication in incubator services.

The new facility could provide merchandising services for inventions that originate at the ICID Research Institute. Services could include scientific assessments, business strategies and market opportunity scans. The facility could also introduce an industry outreach office to act as an interface for inventions with private sector investors, business developers and potential business partners. The ICID Innovation Facility would help package the new processes or potential products as an essential step towards their successful commercialization.

This new entity may not be the immediate priority of the International Centre for Infectious Diseases, but it is vital for the long-term viability of the overall organization and should be explored further.

Lab technicians use state-of-the-art diagnostic equipment to further the fight against infectious diseases.

7.4 ICID Charitable Foundation

The task force recommends the formation of the ICID Charitable Foundation. The mandate of the foundation would be to support innovation, research and public outreach by providing funds raised in innovative ways, from sources that would not otherwise be pursued. It would help locate new funding sources, provide flexibility to direct funds to worthwhile projects, recognize and support researchers and promote Canadian infectious disease capabilities.

Its counterpart foundation in Atlanta has proven that fundraising efforts can effectively target both corporate and individual donors. Similarly, the funds raised by the ICID Charitable Foundation would be available to recognize research excellence, support training programs and assist educational outreach programs in health education, high school science and public health. It would also help develop international partnerships among researchers, businesses, and infectious disease organizations.

The ICID Charitable Foundation would provide another valuable source of incremental funding for scientists and medical specialists involved in research and treatment. While amounts raised would be modest compared to the multi-million dollar research programs of governments and some corporate charitable organizations, this funding would serve as a crucial resource for the ICID Research Institute's innovative projects. The foundation could also leverage matching funds from government and industry.

7.5 Canadian Infectious Disease Clusters

Communities across Canada would benefit from the expansion of clusters in infectious disease research and their related commercial activities.

The task force recommends that the Government of Canada select Winnipeg for a pilot project in infectious disease cluster development to evaluate how local benefits can be generated by national, provincial and municipal governments, working together with the private sector and academic community. The geographic area near the Canadian Science Centre for Human and Animal Health should be given special consideration for such an assessment. The area should be designated for the future development of organizations, facilities and buildings specifically associated with life sciences, and particularly infectious disease research.

The task force recommends the declaration of a biomedical development zone, to be named BioMed City. This approach to cluster development is consistent with a proven development concept and modelled after successful experiences with clusters across North America. BioMed City would be regarded as a combination of a place, people, land, buildings and public infrastructure, growing in close proximity to one another. In this development zone, the poles of activity would be the Canadian Science Centre for Human and Animal Health on one side and the University of Manitoba on the other. Under this arrangement, the area would emerge as an increasingly visible manifestation of Canada's core of resources and capabilities in infectious diseases.

BioMed City should be established and nurtured. The City of Winnipeg, in conjunction with the Province of Manitoba, could have an immediate and far-reaching impact on its development, by proceeding with the following measures:

- explaining to stakeholders the tremendous humanitarian and economic value of establishing BioMed City to anchor the development of Canada's infectious disease capabilities
- declaring the land owned by the City of Winnipeg within the infectious diseases campus to be protected for development towards BioMed City's mission
- establishing an organizational management and governance arrangement through a new entity, or in conjunction with existing economic development agencies, to develop and market BioMed City
- creating physical connectivity and commonality within the infectious disease and life sciences communities and helping link BioMed City resident organizations to Canada-wide and international institutions and networks
- developing special incentives to attract tenants to BioMed City

The area should be designated for the future development of organizations, facilities and buildings specifically associated with life sciences, and particularly infectious disease research.

This approach would encourage coherent real estate use in the area and would also serve as the basis to trigger a community revitalization program designation and funding. It would focus on attracting human and animal health organizations in both public and private sectors to establish and expand in BioMed City.

It is important that a review or study of the designated BioMed City area take place to establish an effective land use plan and the best means to market the site to maximize cluster benefits. The mechanism to maximize benefits might use a development authority, existing agencies or a new organization.

Manitoba's exceptional infectious disease capabilities should be promoted as part of our fast-growing life sciences sector, both in the region and externally to businesses, investors and governments.

BioMed City would involve promoting and marketing Manitoba's infectious disease cluster as a location for new and expanding companies. It would also work to attract companies from other parts of the world to locate their facilities in the cluster. Manitoba's exceptional infectious disease capabilities should be promoted as part of our fast-growing life sciences sector, both in the region and externally to businesses, investors and governments. This could be accomplished through the collaborative efforts of institutions and government organizations such as Western Economic Diversification, Destination Winnipeg Inc., and Manitoba Energy, Science and Technology.

7.6 Infectious Disease Capability

We are also recommending another set of important and specific initiatives related to Canada's infectious disease capability. The reasons for introducing these measures were described earlier in this report, and they constitute important ways governments and academic institutions can reinforce Canada's framework to fight infectious diseases.

- **The Province of Manitoba should pursue an agreement with the State of Georgia** to build on their common interests and complementary approach to infectious disease cluster development. The agreement could focus on a mutual interest in pursuing commercial opportunities within the federal laboratories in each location – laboratories that have already built significant and beneficial links between researchers and technical experts.

- **The Manitoba government should take the initiative to encourage the establishment of an epidemiology network,** which could be a particularly valuable resource in future disease outbreaks.

- **Manitoba universities need to address the challenge presented by the task force to establish more extensive programs related to business studies** in technology transfer, bioinformatics and biosafety.

- **The integration of the two laboratories at the Canadian Science Centre for Human and Animal Health** would offer considerable advantages for research resources to be focused in more cost-effective ways and directed towards more comprehensive solutions.

- **The ongoing growth and development of networks to link researchers in infectious diseases** should be a primary goal for governments to enable collaboration and rapid exchange of research findings and discoveries in this field. One example is the Western Canada Infectious Disease Research Network proposal.

8. IMPLEMENTATION

The task force is offering advice on the sources of funding and procedures that could be followed to implement the recommendations. The establishment of the International Centre for Infectious Diseases would rely primarily on the commitment of resources by the governments of Canada and Manitoba in conjunction with the City of Winnipeg.

8.1 Resource Requirements

The task force projects that a total commitment, in the range of $50–$60 million over a five-year period, will be required from a combination of federal, provincial and municipal governments, the private sector and earned revenue sources.

The primary expenditure areas would be:

- distinguished researcher chairs
- seed funding for the start-up phase of the centre
- BioMed City development, management and marketing
- training program and course development
- operational funds for the ICID Innovation Facility
- ICID Charitable Foundation start-up and operations
- initial ICID Charitable Foundation endowment and contribution matching
- ICID Research Institute initial projects

Dr. Joanne Keselman, Vice–President of Research at University of Manitoba, exchanges views with another task force member.

Within the overall amount cited, a significant portion would be required for capital, land and construction projects for BioMed City, including buildings such as the Level 3 laboratory and business incubator facility.

While these are substantial amounts, they should be seen in the context of their long-term value and near-term potential impact in preventing and responding to infectious disease outbreaks. The calculation of the return on investment in this case must consider the value of preventing future outbreaks of the kind that Canada has just experienced. Funding for the International Centre for Infectious Diseases should be seen for its contribution to reduce the risk of future disease impacts, with their inherently overwhelming economic and public health costs.

(left-right) Dr. Jim Davie, director of the Manitoba Institute of Cell Biology shown here with Dr. Sabine Mai, director of the Institute's Genomic Centre for Cancer Research and Diagnosis. Dr. Mai is developing microscopic tests to analyze genetic material.

8.2 Tripartite Agreement

The three levels of government in Manitoba should pool their resources to establish a joint effort with sufficient funding to enable the growth and development of the province's infectious disease capabilities within the life sciences industry sector. This would involve an agreement among the federal, provincial and municipal governments to specify their commitments and their proportional contributions to support the International Centre for Infectious Diseases and its related cluster initiatives and ventures.

The tripartite agreement would, as its initial investment target, provide resources to help further the establishment of the International Centre for Infectious Diseases. It would also be the basis of support for the crucial initiatives in training, marketing, infrastructure, equipment and research facilities.

It would serve as the primary source for the flow of funds into the new projects and activities envisioned to be part of the International Centre for Infectious Diseases and the related institutions. The federal and provincial governments would be expected to pledge specific levels of financial commitment, while the City of Winnipeg could provide a portion of its share of funds under the agreement in the form of a contribution of services and infrastructure related to the city-owned land in BioMed City.

The projected funding required from governments over a five-year period could be apportioned and allocated through negotiation among the three levels of government.

8.3 Next Steps

This task force has recommended a broad concept of the new structure and process to establish and grow the International Centre for Infectious Diseases, along with a set of important related initiatives. We have tried not to be overly prescriptive about the details of how each component will be organized or operate.

If the governments agree with the concept that has been put forward here, the task of implementing this proposal should be assigned to a core group of task force members. That core group should be assigned the responsibility to produce a detailed business plan by the end of January 2004. Their plan, specifying in detail the projected costs, funding options, preferred governance arrangements and sequence of proceeding with the implementation of the new organization, is essential to guide the procedures and funding decisions that will put this concept into action and make the International Centre for Infectious Diseases a reality.

The declaration of a commitment of the governments to proceed with support for the International Centre for Infectious Diseases should not be delayed by the need to finalize a negotiation of the tripartite funding agreement. The governments could go ahead in February 2004 with initial funding for the first stages, starting with the incorporation of the new not-for-profit institution.

Dr. Robbin Lindsay performs an experiment in infectious disease research.

9. APPENDICES

9.1 Task Force Members and Staff

Co-Chairs:

Terry Duguid	Chairman, Manitoba Clean Environment Commission
Frank Plummer	Scientific Director, National Microbiology Laboratory

Members:

Jane Evans	Manitoba Health Research Council
Henry Friesen	Genome Canada
Robert Gabor	Aikins, MacAulay & Thorvaldson
Jeffrey Hartry	Health Care Products Association of Manitoba
Joanne Keselman	University of Manitoba
John Langstaff	Cangene Corporation
Kevin McGarry	Lombard Life Sciences
Ian Smith	National Research Council
Larry Thiessen	Biovail Corporation
Karin Wittenberg	University of Manitoba

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9.3 Glossary

Acquired Immunodeficiency Syndrome (AIDS). A disease caused by infection with the human immunodeficiency virus. AIDS occurs when an infected patient has lost the ability to fight infections.

Agricultural Terrorism. The use of agricultural goods such as food to distribute chemical, biological, or radiological agents with the intent to cause harm or death, or any attempt to hinder or destroy a country's ability to produce food.

Antibiotic. A substance, such as penicillin or streptomycin, produced by or derived from certain fungi, bacteria, and other organisms, that can destroy or inhibit the growth of other microorganisms.

Antimicrobial Resistant Organisms. Bacteria that have adapted to become resistant to traditional antibiotics and other treatment regimens, thus becoming difficult to treat.

Arterial Plaque. A semi-hardened accumulation of substances such as cholesterol and other fats that form on the walls of the arteries and may contribute to a stroke or heart attack.

Bacteriologists. Scientists who study bacteria.

Bioinformatics. The collection, classification, storage, and analysis of biochemical and biological information using computers especially as applied in molecular genetics and genomics.

Biosafety. Safety with respect to the effects of biological research on humans and the environment

Bioterrorism. The intentional use of disease-causing organisms to cause harm or death.

Bovine Spongiform Encephalopathy (BSE). Also called mad cow disease, is caused by proteins called prions that can cause loss of cells in the brain of the host. Variants have been found in cows and humans and may be transmitted to humans by eating tainted beef.

Bronchitis. Acute or chronic inflammation of the bronchial tubes.

Chlamydia pneumoniae. The name of the most common sexually transmitted disease and the organism that causes it. Symptoms include an abnormal discharge from the vagina or penis or pain when urinating.

Cholera. A disease that causes profuse watery diarrhea that leads to rapid dehydration and possibly death.

Clinical Microbiologists. Medical doctors and scientists who study humans infected with bacterial and viral diseases.

Cluster. A grouping of similar, related or complementary organizations in a geographically defined area.

Communicable Disease. A disease that can be spread from person or animal to another person.

Crohn's Disease. Inflammation of the distal portion of the ileum, often spreads to the colon, and is characterized by diarrhea, cramping, and loss of appetite and weight with local abscesses and scarring.

Dengue. A virus transmitted by mosquito that can cause severe bleeding from the mouth, eyes, and digestive tract. It is also known as dengue hemorrhagic fever.

E. coli. A common bacterium that lives everywhere in the environment including the digestive tract of humans and animals. Some strains of *E. coli* are beneficial while others cause disease.

Epidemic. The term used to indicate when the incidence of a specific disease is greater than that normally seen in a population.

Epidemiology. The study of epidemics including where, when, and how they happen. This knowledge is used to predict epidemics and learn how to prevent or contain them.

Haemophilus influenzae Type B. Bacterium capable of causing a range of diseases including ear infections, cellulitis (soft tissue infection), upper respiratory infections, pneumonia, and such serious invasive infections.

Hanta Virus. A virus that may cause fatigue, fever, and muscle cramps, headaches, dizziness, chills, nausea, vomiting, diahrrea, and stomach pains. In more severe cases, the lungs can fill with fluid and cause death. It is transmitted to humans by contact, direct or indirect, with the saliva and droppings of rodents.

Helicobactor pylori. Bacteria found in the stomach is responsible for gastritis and peptic ulcers.

Hepatitis B. A strain of a virus that causes inflammation, swelling, scarring, and cancer of the liver.

Herpes Simplex Virus Type 2. A herpes virus that causes genital herpes, which is characterized by sores in the genital area. Genital herpes is a sexually transmitted disease (STD).

Human Immunodeficiency Virus (HIV). A virus that infects cells of the human immune system and causes their destruction leading to AIDS.

Human Papilloma Virus (HPV). A family of over 60 viruses responsible for causing warts. The majority of the viruses produce warts on the hands, fingers, and even the face. Most cause nothing more than cosmetic concerns. Several types, however, produce genital warts and elevate the risk for cancer of the cervix.

Infectious Disease. An illness caused by a microorganism, virus, or other disease-causing entity that can be spread and cause serious illness and death.

Influenza. The flu is caused by viruses that infect the respiratory tract which are divided into three types, designated A, B, and C.

Leprosy. A chronic infection caused by a bacterium that affects various areas of the body, particularly the skin and nerves. The typical early signs of leprosy are flat or slightly raised patches on the skin. Patients feel nothing in the affected area. The skin and nerve damage often lead to disfigurement and disability.

Magnetic Resonance Imaging (MRI). A special radiology technique designed to image internal structures of the body using strong magnetic fields and energy changes in a molecule combined with a computer calculation to produce images of body structures.

Malaria. An infectious parasitic tropical disease transmitted by the Anopheles mosquito and characterized by high fever, shaking, chills, sweating, and anemia.

Microbiology. The study of mostly one celled microscopic organisms including bacteria, yeast, and fungi which may cause human disease.

Mycobacterium tuberculosis. The bacterium that causes tuberculosis.

Parasitologists. Scientists who study parasites.

Reactivated Tuberculosis. Tuberculosis that has become active after a latent period.

Recurring Pneumonia. Inflammation or infection of the lungs characterized by the air sacs filling with fluid preventing normal function, which occurs repeatedly.

Schizophrenia. One of several brain diseases whose symptoms may include loss of personality (flat affect), agitation, catatonia, confusion, psychosis, unusual behavior, and withdrawal. The illness usually begins in early adulthood.

Severe Acute Respiratory Syndrome (SARS). A severe form of pneumonia characterized by cough, fever, shortness of breath and difficulty breathing.

Sexually Transmitted Disease (STD). One of a number of diseases that may be acquired through sexual contact.

Shigellosis. An infection by Shigella bacteria that causes fever, stomach cramps and diarrhea containing bloody mucous. It may be spread in food or from person to person.

Smallpox. An infectious disease caused by the variola virus that causes fever, vomiting, headache, backache, and a blister-like rash on the body. It may be spread through clothing, sneezing, and saliva.

Technology Transfer. The process of converting scientific findings, knowledge or capabilities from research laboratories into useful products by the public and commercial sectors.

Tuberculosis. A bacterial disease, which may be passed through coughing or sneezing, that causes pneumonia and lymph node enlargement and is marked by fatigue, loss of appetite, chills, fever and night sweats.

Virologist. A scientist who studies viruses.

West Nile Virus. A virus transmitted by mosquitoes that may cause encephalitis.

Zoonotic Infection. A disease that can be transmitted from animals to humans including diseases such as West Nile encephalitis and Hanta Virus pneumonia.

Zoonotic Origin. A disease that was transmitted from animals to humans that can subsequently be spread from human to human such as AIDS, SARS and influenza.

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BUILDING THE DREAM

Although the International Centre for Infectious Diseases still remains a vision, over the past three years the University of Manitoba, the National Microbiology Laboratory and other partners such as the NRC Institute for Biodiagnostics, Smith Carter Engineers and Architects Inc. and TR Labs have been working together in close collaboration. Early achievements of the collaboration indicate what is possible through this new way of doing business across sectors. Some of the more major accomplishments include:

- **Growing the critical mass of infectious disease scientists:** The concept of an international centre of research excellence has been central in attracting world-class scientists to work in Manitoba and Canada. Recently, 13 outstanding scientists have been recruited to Canada from Germany, the United Kingdom and the United States, bringing the total of infectious disease scientists working in the International Centre for Infectious Diseases collaboration to over 60. As the critical mass of science continues to grow through the proposed International Centre for Infectious Diseases, so too will the attraction for more renowned Canadian and international scientists.
- **Earning and obtaining external funding:** Scientists in the collaboration have increased their research resources to a level of $10 million annually through competitive funding from the Canadian Institutes for Health Research, the U.S. National Institutes of Health, the Canada Foundation for Innovation and other important sources.
- **Increasing scientific discovery and innovation:** The International Centre for Infectious Diseases collaboration has been instrumental in several initiatives, including the sequencing of the SARS coronavirus genome and proteins, and the development of new diagnostic tests for SARS and bioterrorism agents, vaccines and treatments for viral hemorrhagic fevers and SARS. In 2003 alone, 10 patent applications were filed by scientists in the collaboration. Their innovation extends beyond biotechnology to high-containment construction and biosafety, and information systems for infectious disease surveillance.
- **Developing the next generation of scientists:** Canada's innovation agenda and the knowledge-based economy requires an infusion of new scientific talent. The National Microbiology Laboratory hosts more than 60 undergraduate science students annually, through co-operative student programs that are in place in Canadian universities from Victoria to Halifax. Currently, 35 University of Manitoba graduate students and post-doctoral fellows are studying under scientists at the National Microbiology Laboratory.
- **Providing national and international leadership:** Scientists in the International Centre for Infectious Diseases collaboration work in close partnership with other scientists across the country and around the world. Researchers from Germany, Italy, the United States, Mexico and Japan regularly visit the National Microbiology Laboratory to use its unique facilities. National Microbiology Laboratory scientists are leaders in national initiatives, such as the SARS Research Consortium and the Western Canada Infectious Disease Network. Co-operative research on HIV includes programs in Kenya and India, while collaboration on emerging infectious diseases extends to Kenya, Iran, Paraguay, Cuba and other parts of Latin America through the Pan American Health Organization.

The creation of the International Centre for Infectious Diseases will build on the collaboration's significant progress to date. In making this institution a reality, we will be one step closer to maximizing Canada's capacity to fight infectious disease, and to a future that ensures the health and well-being of all Canadians.