

## Commentary

### Fostering Drug Research and Development for Neglected Tropical Diseases in Canada

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## Abstract

Neglected diseases (ND) are diseases for which treatments are often toxic, inadequate or non-existent and for which there is no economic incentive for drug development. The most neglected of these diseases are the neglected tropical diseases (NTDs). Over the last decade the Canadian Institutes for Health Research (CIHR) have spent only 0.47% of their budget on NTD basic science research, despite the fact that NTDs affect one billion people globally. Taking Canada as an example, we explore the role of high-income countries in addressing the global need for new drugs to treat NTDs. We describe current efforts in NTD research by the Canadian government and universities in Canada, outline challenges associated with funding for this type of research and provide recommendations to increase research on this neglected problem.

## Introduction

Neglected diseases (NDs) are ailments that cause significant morbidity or mortality, but for which treatments are unavailable, ineffective or toxic. These conditions, which include HIV/AIDS, tuberculosis, malaria and neglected tropical diseases (NTDs), primarily affect impoverished individuals in low- and middle-income countries [1; 2]. The relative lack of a market for drugs that treat these diseases has inhibited drug research and development (R&D) on NDs to date. A number of studies have demonstrated that NTDs, a collection of helminth, protozoan and bacterial infections, are the most neglected of diseases relative to their global burden of disease (GBD) [3; 4], receiving only 0.016% of the US\$160 billion allocated to health

research globally [4]. Of the 1556 new medical products marketed between 1975 and 2004, only 21 were for tropical diseases (including HIV, malaria and tuberculosis) and a mere 10 were directed at NTDs [5]. Approximately 1 billion people are infected with one or more NTD [6] leading to 530,000 deaths annually and a GBD of 57 million Disability Adjusted Life Years (DALYs) [3]. This compares to 84.5, 46.5 and 34.7 million DALYs for HIV/AIDS, malaria and tuberculosis, respectively [3]. In addition, DALYs are thought to systematically underestimate of the NTD burden since the calculation does not consider the chronic long-term nature and presence of sub-clinical morbidities related to NTDs [3; 7].

Many have advocated for an increase in drug R&D for NTDs, alongside other medical, social and economic interventions since effective treatments are predicted to have both positive health and economic impacts [8; 9]. Given the lack of market incentives, however, it is unlikely that new drugs will be developed without the input of key stakeholders. Recently, the World Health Organization (WHO) Intergovernmental Working Group on Public Health, Innovation and Intellectual Property have emphasized the need for new R&D incentive mechanisms (e.g. prize funds that reward the development of innovative medical interventions), IP strategies such as patent pools, and an increase in contributions to global R&D, proportional to their relative wealth, from all countries [10]. In this commentary we analyze how Canada has responded to the NTD R&D crisis within both government and academic institutions. Based on this analysis, we comment on the potential for Canada to mitigate the suffering of the world's poorest and most vulnerable people.

### **The Role of the Canadian Federal Government**

The Canadian Institutes for Health Research (CIHR) is Canada's largest federal funding agency that supports research in the health sciences. Traditionally, the mandate of the CIHR has been to prioritize research related to health problems that affect Canadians [11]. However, CIHR's statement on International Collaborations in its 2005-2006 Awards Guide declares that:

*"CIHR encourages applications in the field of global health, which demonstrate that the proposed research project has the potential to improve the health of people in Canada and the World."* [12]

In line with this statement, CIHR has become involved in partnerships with other Canadian granting agencies (e.g. The Global Health Research Initiative) and the Bill and Melinda Gates Foundation Grand Challenges in Global Health Research (via a CDN\$4 million donation). Given that CIHR simultaneously encourages global health research while needing to prioritize Canadian research needs, we were interested to see what funding would be available for NTDs; since these diseases that do not impact Canadians directly. To specifically investigate funding availability for NTD research, we used NTD keywords (Appendix 1) as search terms to retrieve data from publicly available CIHR funding decision records covering the period from 1999-2009. Analysis of these data revealed that over the last decade, biomedical researchers were awarded CIHR grants and fellowships in the amount of CDN\$29.8 million to study NTDs out of a total of CDN\$6.4 billion (Figure 1) with the majority of funding (CDN\$21 million, 70%) being allocated to studies involving leishmania (Figure 2). Overall, this represents 0.47% of the total CIHR research budget from 1999-2009, compared to 4% for HIV, 0.25% for malaria and 0.56%

for TB research in the same period. When compared to the global disease burden as measured by each disease's percent of total DALYs [13] this discrepancy is further illustrated (Figure 3).

The Canadian government's involvement in solving the NTD R&D crisis can be compared globally. The first Global Funding of Innovation for Neglected Diseases Report (G-FINDER) (Moran 2009) looked at national contributions to ND research (including HIV/AIDS, TB, malaria and NTDs). Canada ranked as eighth in the world, contributing a total of US\$19 million of public funding for ND R&D in 2007. These contributions were from the CIHR, Canadian International Development Agency and Public Health Agency of Canada, representing 0.001% of the national GDP (Appendix 2). The US government, meanwhile, represented nearly three quarters of global public spending with an investment of US\$1.25 billion in 2007, which corresponds to 0.009% GDP - nine times the Canadian equivalent. The European Union accounted for US\$384.9 million (0.003% GDP), primarily from the UK, the Netherlands, Republic of Ireland, and Sweden. Recently, at a G8 meeting in 2008, UK government officials announced that they would contribute GB£50 million over five years toward the control and elimination of NTDs, and the US government pledged US\$350 million over a five-year period towards global NTD control efforts [14]. Unfortunately, Canada has made no such commitment to NTD research.

The Canadian government's investment in research for NDs generally, and NTDs specifically, has room for improvement. For example, Canada could increase the total CIHR research budget or prioritize funds for NTDs. We note that recently, the CIHR has made a move to support NTD research by co-funding an NTD research chair with iCo Therapeutics to Kish Wasan at UBC [15]. Canada could also contribute indirectly through external NTD R&D initiatives, such as the Drugs for Neglected Diseases initiative ([www.dndi.org](http://www.dndi.org)). Additionally, to further support for NTD research, we recommend that federal research funding agencies formally report all basic science and drug R&D spending on NTDs.

The Canadian government has an opportunity in this setting to be a leader in health diplomacy on the global stage. Canada could begin by setting legal standards for patent pools, or by setting up an international or Canadian prize fund for NTD drug development [16]. Canada could also foster an increase in NTD drug R&D in biotech and biopharmaceutical industries via tax incentives, regulatory exclusivity (similar to orphan drug development in the US [17]) and review vouchers (comparable to the US FDA vouchers for NTD drugs [18]).

### **The Role of Universities**

Collectively, Canadian universities account for 36% of research conducted in Canada, worth an estimated CDN\$10.4 billion annually [19]. As public institutions, their visions include performing research for the benefit of all humanity locally and globally [20-22] (Table 1). Given these commitments, NTD R&D should be fostered at universities [23]. There are some indications that this change in research priority is beginning to occur. For example, at the University of McGill, the Institute of Parasitology is conducting research on four NTDs [24], however there are only a few such initiatives across Canada.

Universities can effect change by fostering awareness and education about NTDs as a significant

element of global health inequity. Universities can encourage new graduates to pursue NTD research through scholarships for graduate students and positions for postdoctoral fellows. They can also form initiatives that foster an NTD scientific community. In line with this, universities can also coordinate efforts by stakeholders in NTD R&D by hosting conferences and workshops. One such initiative is the Neglected Global Diseases Initiative at UBC, which aims to have a workshop on multidisciplinary NTD research at UBC in January 2010. Another development of great interest at UBC is the Centre for Drug Research and Development ([www.cdrd.ca](http://www.cdrd.ca)), which represents a new model for preclinical drug research at universities, and could theoretically be harnessed in the future for NTD research purposes.

To address funding challenges directly, money could be directed from endowment funds to NTD R&D, or new endowments could be established for this purpose. In addition, universities are encouraged to carefully patent and license NTD innovations to ensure developing world access. For example at UBC, a new oral treatment for leishmaniasis was licensed in 2007 with such provisions [25].

Within each of these efforts, Canadian universities should partner with universities in NTD-endemic countries, through north-south initiatives for curriculum development, research collaborations, online communities, or direct financial aid for travel to conferences or research programs.

## **Conclusion**

Efforts to address the NTD R&D crisis within Canada are occurring at both the government and institutional level, yet are insufficient relative to the global burden of disease of these infectious diseases. While there are many challenges associated with NTD R&D in high-income countries, solutions do exist (Table 2). In addition, these proposed solutions can be extended to other areas of ND research in general, such as malaria, HIV/AIDS, TB, diarrheal illness, nutritional health, maternal health, and treatment of chronic diseases in resource-poor settings. By uniting the efforts of government, universities, industry and NGOs, Canada can act as a world leader in solving the NTD R&D crisis. Over one billion people in the world deserve a better life free from NTDs; Canada has both the responsibility and ability to act. Hopefully our country will recruit the political will to do so.

## Figure Legends

**Figure 1. CIHR funding for NTDs.** Grants awarded for neglected tropical disease research by CIHR from 1999-2009 in \$CDN millions, and percentage of total research budget.

**Figure 2. CIHR funding for NTDs per disease.** NTD funding in CDN\$ millions from 1999-2009, per disease. “Other” includes human African trypanosomiasis, onchocerciasis, lymphatic filariasis, schistosomiasis, and hookworm.

**Figure 3. NTDs do not receive enough basic science funding per global burden of disease.** The percentage of total CIHR spending on HIV-AIDS, malaria, tuberculosis (TB) and NTDs between for 1999-2009 compared to the percentage of total global DALYs [13]. Note that the % DALY for NTDs is likely to be an underestimate [3; 7]

**Table 1. Excerpts from Canadian university vision or mission statements**

**Table 2. Summary of recommendations.** These recommendations could be extended to other areas of neglected research, such as malaria, HIV/AIDS, TB, diarrheal illness, nutritional health, maternal health, and treatment of chronic diseases in resource-poor settings.

**Appendix 1. List of search terms for NTDs [3] and funding**

\*All “leishmaniasis” grants found to overlap with search term “leishmania”

**Appendix 2. Calculations of US\$/GDP spent by country/region on neglected disease research**

## References

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