NRC Research Press

PREFACE

Genomics: the Power and the Promise[1]

Gerardo Jimenez-Sanchez

It has been 25 years since the Human Genome Project began. After 13 years of an unprecedented multi-group effort, rigorous scientific work, and technological progress, along with great vision and leadership, the Project achieved its goal: sequencing the three billion base pairs in the human genome. This effort and subsequent genomics initiatives have resulted in a significant advancement in our knowledge of biology, technology development, and a novel work system to conduct science by intensive collaboration of multiple experts in different disciplines located around the world. To celebrate this anniversary, Eric Green, James Watson, and Francis Collins shared some of the lessons learned from such an ambitious initiative that has transformed the way biomedical research is conducted today (Green et al. 2015). The results of this valuable experience provide a vast array of opportunities for scientific innovation to benefit humankind.

Genomics has become a major driving force to generate new products and services that can contribute to alleviating global challenges affecting the world's population. By harnessing scientific, technological, and industrial innovation initiatives, strengthened by public–private associations, genomics can contribute to health care, food sufficiency, alternative sources of energy, and care for the environment (Jimenez-Sanchez and Philp 2015). Although there is a long way to go before such innovations become a reality, the potential of genomics innovation offers powerful opportunities to increase social welfare, economic growth, and cultural enrichment.

Progress in genomics innovation comes along with new challenges and potential risks that go beyond the strict boundaries of science. Its intimate relationship with humankind and society makes it implicit the need for timely and appropriate public policies that, while fostering genomics innovation, ensure a responsible development by regulating its ethical, environmental, economic, legal, and social implications. Examples of these include principles, guidelines, and best practices to define the nature of scientific evidence required to bring a medical innovation into the clinical practice, as well as criteria for their reimbursement, communication of DNA results to patients, appropriate use of technologies, as well as the use of genomics in commerce, agriculture, and exploitation of natural resources, among many others.

Similar to other areas of product development for high-value markets, competition in genomics innovation is becoming intensive around the world, particularly among the most developed countries (OECD 2009). Creative synergies between governments, academia, and industry have proven to be a successful strategy to increase effectiveness in bringing innovations from the laboratory to the marketplace, under regulatory frameworks that include public opinion and societal believes at their core. There are countries where the virtuous cycle of connecting ideas and people across sectors to find new uses for genomics, attracting sustained investment, and translating discoveries into applications has been successful. Without any doubt Canada is among the leaders.

From the dawn of the genomics era, Canada has implemented a visionary strategy to lead genomics innovation and derive economic and social benefits to their population. Genome Canada (www.genomecanada.ca), a central component of the strategy, was created in 2000 as a not-for-profit organization. This organization catalyzes the nation's genomics efforts by building strategic partnerships and making the necessary investments in people, technology, and programs to fuel the research pipeline from discovery to real-world solutions across key sectors. Moreover, it fulfills their national Science, Technology, and Innovation strategy in areas that include health, agriculture, forestry, fisheries and aquaculture, energy, mining, and the environment. With six regional Genome Centres across the country and a new 10-node Genomics Innovation Network, Genome Canada facilitates access to leading edge technology, stimulates different approaches to project development and fundraising, and provides opportunities for public outreach programs at a regional level. These efforts harness Canada's collective power for

Received 26 October 2015. Accepted 26 October 2015.

Corresponding Editor: M.E. Cristescu.

G. Jimenez-Sanchez. Harvard T.H. Chan School of Public Health, Department of Epidemiology, Boston, MA, USA; Global Biotech Consulting Group, Mexico.

E-mails for correspondence: gjimenez@hsph.harvard.edu; gerardo.jimenez@gbcbiotech.com.

[1]This preface is part of a Special Commemorative Issue marking the one-year anniversary of "Genomics: the Power and the Promise 2014".

Published at www.nrcresearchpress.com/gen on 7 December 2015.

the advancement of genomics research (Genome Canada 2015).

This strategy includes permanent efforts to building awareness about the value of genomics, as well as the social and economic benefits that these investments bring to their population. In November 2014, Genome Canada co-hosted the second edition of its signature event "Genomics: The power & the promise" in partnership with The Gairdner Foundation. It attracted more than 350 participants to Ottawa, including visionaries and experts in genomics from across North America, to dialogue on cutting-edge advances in the field (Genome Canada and The Gairdner Foundation 2014).

As part of that effort, *Genome* has produced this special issue of the journal devoted to capturing some of the forward-looking initiatives presented during the meeting. It includes the use of a comprehensive framework to develop public policies for pharmacogenomics testing, a report from a thorough consultative process to address issues concerning the return of research results and incidental findings in pediatric research, development of novel technologies to assess informative biomarkers, use of DNA barcodes to address commercial issues with food for human consumption, genomics strategies to improve selection of heifer reproduction and calf performance traits in beef cattle, as well as current views of how genomics innovation is transforming healthcare, business, and the global economy.

Although it is still early in the process of generating effective cross-sector applications, there is no question that genomics is a game changer in the way we conduct science and innovation. Moreover, it has become a major driver for the bioeconomy. This is the time for countries and regions to embrace genomics research and technologies, and translate them into benefits for the global population. The power and the promise of genomics provide unprecedented opportunities to develop innovations and tackle global challenges that are threatening the human civilization in an unprecedented way.

References

Genome Canada. 2015. Annual Report 2014–2015. Available from www.genomecanada.ca/medias/PDF/EN/annual_report_2015_2/index.html.

Genome Canada and The Gairdner Foundation. 2014. Genomics: the Power and the Promise 2014. Post Conference Magazine. Available from www.genomecanada.ca/medias/pdf/en/genomics-power-promise-2014/index.html.

Green, E.D., Watson, J.D., and Collins, F.S. 2015. Human Genome Project: Twenty-five years of big biology. Nature, **526**: 29–31. doi:10.1038/526029a. PMID:26432225.

Jimenez-Sanchez, G., and Philp, J. 2015. Omics and the bioeconomy: applications of genomics hold great potential for a future bio-based economy and sustainable development. EMBO Reports, **16**: 17–20. doi:10.15252/embr.201439409. PMID:25476709.

OECD. 2009. The bioeconomy to 2030 — designing a policy agenda. OECD Publishing, Paris, France. Available from http://www.oecd.org/futures/bioeconomy/2030.