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Letter to the Editor

From Solo in the Silo to Strategic Training Programs

Marianne Koritzinsky,[1,2,3,4,*] C. Anne Koch,[1,2,4,5,6,*] Barbara Riley,[7,*] Nicole Beauchemin,[8,9] Gerry Johnston,[10,11] Michael Johnston,[10,12] James Koropatnick,[13] Carmen G. Loiselle,[14] Magdalena Maslowska,[8] Craig McCormick,[10,11] Wilson H. Miller, Jr.,[15] Lois Mulligan,[16] and Ming-Sound Tsao[4,5,17,18,19]

[1]Terry Fox Foundation Strategic Training Initiative for Excellence in Radiation Research for the 21st Century at CIHR, [2]Department of Radiation Oncology, [3]Institute of Medical Science, [5]Department of Medical Biophysics, and [17]Department of Laboratory Medicine and Pathobiology, University of Toronto, Toronto, ON M5S 2J7, Canada; [4]Princess Margaret Cancer Centre and Campbell Family Cancer Research Institute, [6]Radiation Medicine Program, and [18]Department of Pathology, Princess Margaret Cancer Centre, University Health Network, and [19]Terry Fox Foundation Strategic Training Initiative in Health Research for Clinician Scientists in Molecular Oncologic Pathology at CIHR, Toronto, Ontario, M5G 2M9, Canada; [7]CIHR Training Program in Population Intervention for Chronic Disease Prevention: A Pan-Canadian Program and Propel Centre for Population Health Impact, School of Public Health and Health Systems, University of Waterloo, Waterloo, ON N2L 3G1, Canada; [8]McGill Integrated Cancer Research Training Program, Goodman Cancer Research Centre, and [9]Departments of Biochemistry, Medicine, and Oncology, McGill University, Montreal, QC H3G 1Y6, Canada; [10]Terry Fox Cancer Research Training Program for Atlantic Canada, Beatrice Hunter Cancer Research Institute, [11]Department of Microbiology and Immunology, and [12]Department of Surgery, Dalhousie University, Halifax, NS B3H 4R2, Canada; [13]Lawson Health Research Institute CIHR Strategic Training Program in Cancer Research and Technology Transfer and Western University, London, ON N6A 4L6, Canada; [14]Psychosocial Oncology Research Training and Ingram School of Nursing and Department of Oncology, McGill University, Montreal, QC H3A 2A7, Canada; Segal Cancer Centre and Jewish General Hospital, Montreal, QC H3G 1Y6, Canada; [15]Segal Cancer Centre and Lady Davis Institute, Jewish General Hospital, Department of Oncology, McGill University, Montreal, QC H3G 1Y6, Canada; [16]Terry Fox Foundation Training Program in Transdisciplinary Cancer Research in Partnership with CIHR and Division of Cancer Biology and Genetics, Cancer Research Institute at Queen's University, Kingston, ON K7L 3N6, Canada

To the Editor:

The traditional model for graduate and postgraduate training in health sciences is based on years of exceptionally talented individuals' full immersion in specific research projects, guided by accomplished mentors with matching expertise. This model is perceived to be essential for the development of outstanding, critically thinking independent scientists and to ensure that research dollars are spent wisely. However, this model does not offer any formal solution to two educational needs that have arisen in recent years: the need for training in translational and transdisciplinary team science (Choi and Pak, 2006) and, since most graduate students will not end up as academic scientists (Mitchell *et al.*, 2013), the need to train researchers who can work in diverse settings.

Transdisciplinary research has emerged as a relatively new concept, referring to the holistic integration of branches of knowledge beyond the merely additive or interactive (Choi and Pak, 2006). The goal of this knowledge integration is to create new perspectives and results and to transcend the "silos" of traditional discipline boundaries. A transdisciplinary approach responds well to the real-life knowledge continuum and complexity of today's research practices, which are also reflected by the increasing dominance of teams in knowledge production (Wuchty *et al.*, 2007). Shortly after its inception in 2005, the Canadian Academy of Health Sciences (CAHS) sought to develop a framework for assessing

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*These primary authors contributed equally. The remaining authors are listed alphabetically

Address correspondence to: Marianne Koritzinsky (mazinsky@gmail.com)

Canadian interdisciplinary health research. It was acknowledged that universities need to support and enhance this research for the benefit of science and to meet the requirements for creating intellectual capital sought by government and industry (Hall *et al.*, 2006). Current traditional training models fall short of meeting these requirements.

To build capacity within Canada's health research community and support the development of transdisciplinary collaborative team research, the Canadian Institutes of Health Research (CIHR) launched the Strategic Training Initiative in Health Research (STIHR) in 2002. The objectives of this program were to integrate training encompassing ethical conduct, knowledge translation, and professional skills such as communication, teamwork, project management, leadership, grant writing, and peer review (CIHR, 2009). In 2009, the Natural Sciences and Engineering Research Council of Canada (NSERC) launched the Collaborative Research and Training Experience (CREATE) program, which similarly supports collaborative and integrative training to facilitate the transition of new researchers to productive employees in the Canadian workforce (NSERC, 2014). Since their inception, more than CAN$300,000,000 has been invested in supporting trainees in these strategic training programs (STPs; CIHR, 2009; NSERC, 2014). Each STP imparts transdisciplinary aspects of research and professional skills in a focused context, such as cancer biology or mental health for STIHRs, and clean combustion engines or thermo-electrics for CREATE.

STPs aim to complement rather than replace the traditional immersion model. In addition to their regular graduate or postgraduate work, trainees become part of a community of scholars linked by their topics of study but diverse in terms of their primary disciplines and projected career paths. STPs include a unique blend of trainees from the master's through the doctoral and postdoctoral levels as well as medical residents and clinical fellows. Within the framework of a topic such as cancer research, trainees may be engaged in projects focusing on molecular mechanisms, medical imaging, psychosocial oncology, policy making, or population health (Loiselle *et al.*, 2004, 2008; P'ng *et al.*, 2012; Riley *et al.*, 2013). Several STPs have nodes based at universities across the country, establishing unique networks of trainees and educators (Propel Centre for Population Health Impact [PCPHI], 2014). They also offer exchange programs and promote collaborative research projects involving mentors from different disciplines (PCPHI, 2014). In this way, STPs provide the infrastructure for increased interactions between trainees and mentors; exposure to a broader research landscape; engagement with policy and practice sectors; and communal learning of professional skills and a curriculum that includes policy making, ethics, innovation, and commercialization. The CAHS committee highlighted the STIHR model as a cutting-edge initiative to advance interdisciplinary health research agendas (Hall *et al.*, 2006).

STPs have a unique ability to respond quickly to policy change or new educational initiatives and implement them for current trainees. For example, an STP on Population Intervention for Chronic Disease Prevention (PICDP) linked trainees, academic mentors, and representatives from government and nongovernment organizations to shape programs of research and knowledge translation in timely areas such as nutrition labeling and electronic cigarettes (PCPHI, 2014). Many STPs align well with and strengthen university curricula (PCPHI, 2014) and have resulted in innovation in the form and delivery of research education. Nationwide program nodes have stimulated implementation of interactive online courses and workshops and a unique interuniversity common curriculum (PCPHI, 2014). PICDP, for example, also developed and administered a new online course involving four instructors from two universities available to graduate students from all institutions across Canada (PCPHI, 2014). Innovation and capacity building in teaching are therefore valuable products of STPs. STPs have come to represent an important educational intersection between university and funding agencies wherein mutually reinforcing goals of teaching and innovation are nurtured.

To date, ~20,000 trainees have been involved in Canadian STPs (CIHR and NSERC, personal communication). Many alumni continue as researchers in the academic, clinical, or industrial realm, others hold important strategic positions such as research policy analysts in the government and directors of research in global science organizations (Loiselle *et al.*, 2004, 2008; Kirmayer *et al.*, 2008; Loisel *et al.*, 2009; Stewart *et al.*, 2010; MacDonald *et al.*, 2012; P'ng *et al.*, 2012; Riley *et al.*, 2013). However, in spite of extensive activity reporting and alumni tracking within STPs, appropriate and uniform evaluation approaches lag behind. Training programs including STPs are usually evaluated by readily quantifiable scholarly products, such as publications, patents, and presentations (Dores *et al.*, 2006; P'ng *et al.*, 2012), although a comparison population is rarely identified and the metric benchmarks are fundamentally linked to specific disciplines. Furthermore, these metrics do not fully capture the range and interplay of benefits of the training programs, such as new conceptual frameworks; increased quality and quantity of transdisciplinary, translational, and team-based research; community building; and teaching innovation. Approaches that have been developed to measure the value of collaboration and transdisciplinary integration in team science (Masse *et al.*, 2008; Hall *et al.*, 2012) may represent a resource for establishment of evaluation frameworks for STPs.

We hypothesize that the STP model constitutes a distinct improvement over the immersion training model, representing a valuable response to the current needs and challenges in science education. Establishment of an evaluation framework is vital to test this hypothesis.

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