Canadian Cancer Research Alliance
Alliance canadienne pour la recherche sur le cancer

Canada's Investment in

Early Translational Cancer Research, 2005–2019

CANADIAN CANCER RESEARCH SURVEY

Since 2005, CCRA members have prioritized the quantification of Canada's cancer research funding. To that end, the CCRA's Canadian Cancer Research Survey (CCRS) wascreated, a database that has evolvedover time to track the research investments made by over 40 organizations.

The CCRS is estimated to cover about 60–80% of the research investments made in Canada throughpeer-reviewed processes. Data are updated and corrected annually and will vary from previously published reports. Investment numbers may differ from those reported by contributing organizations because of methodological conventions like the prorating of budgets.

THIS REPORT

Cancer exacts a considerable toll. There is increasing emphasis on identifying ways to "translate" research and accelerate the speed at which the public starts to benefit from research advances. The end goal is the application of precision medicine.

This brief report provides an overview of the level and nature of the investment in **early** translational cancer research made by Canadian research funding organizations. Early translational cancer research includes credentialing and pre-clinical research in animal and tumour models as well as early clinical research and trials to develop, refine, and assess the utility in humans of new diagnostic and prognostic biomarkers, treatments, and preventive therapies. Clinical findings may, in turn, inform pre-clinical research so this is an iterative rather than a unidirectional process.

For this report, relevant research projects were coded to the classification below. Implementation research, which is designed to transfer clinical findings to practice settings and communities, is not included in this classification as it is the later part of the research continuum. Of note, relevant Centres of Excellence for Commercialization and Research (CECR) initiatives through the National Centres of Excellence of Canada were included as Major Initiatives in this analysis.

PROJECT CLASSIFICATION FOR EARLY TRANSLATIONAL CANCER RESEARCH [1]

<table>
<tr><th rowspan="2">PHASE</th><th colspan="5">MODALITY</th></tr>
<tr><th colspan="2">RISK ASSESSMENT (RA)
Research intended to characterize the cancer-related health status of an individual</th><th colspan="3">INTERVENTIVE (INT)
Research intended to change the cancer-related health status of an individual via prevention or treatment</th></tr>
<tr><td>PRE-CLINICAL [2]
CLINICAL [3]</td><td>I. Biospecimen-based (biomarkers)</td><td>II. Image-based (imaging)</td><td>I. Agents (drugs & biologics)</td><td>II. Immune Response Modifiers (immunotherapies)</td><td>III. Interventive Devices (devices)</td></tr>
<tr><td>MAJOR INITIATIVE</td><td colspan="2">Centres, networks, and platforms that support risk assessment research - e.g., Ontario Cancer Biomarkers Network, BC Clinical Genomics</td><td colspan="3">Centres, networks, and platforms that support interventive research - e.g., BioCanRx, Canadian Cancer Clinical Trials Network (3CTN)</td></tr>
</table>

[1] Adopted from E.T. Hawk et al. (2009). The Translational Research Working Group Developmental Pathways: Introduction and Overview. *Clinical Cancer Research,* 14(18), 5664–5671.

[2] Includes all research from post-discovery to pre-clinical, where new modalities are created and tested using model systems.

[3] Includes phases I, II, and II/III clinical trials and excludes phase III or later stage clinical research.

Page 3 of this report presents annual investment in early translational research, while page 4 shows the proportion of the investment by key attributes for 2019 (graphs) and for the three five-year periods (tables).

Access interactive visualizations and a related slide deck at

www.ccra-acrc.ca.

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Investment Trend

From 2005 to 2019, $3.1B was invested in early translational cancer research, of which $740M was in major initiatives, which are major platforms designed to accelerate early translational research primarily through programs of the Canada Foundation of Innovation (CFI) and Networks of Centres of Excellence (NCE). The early translational research investment represented 51% of overall cancer research investment in 2019.

Major Funders

All organizations tracked in the CCRS had some investment in early translational research. Excluding major initiatives (referenced above), 62% of the 15-year investment was for research funded by the Canadian Institutes for Health Research (CIHR), Ontario Institute for Cancer Research (OICR), Canadian Cancer Society (CCS), The Terry Fox Research Institute (TFRI), and the Natural Sciences and Engineering Research Council (NSERC).

Investment by Province

The largest shares of the early translational research investment went to nominated (lead) PIs based in Ontario and Quebec—many major initiatives, which involve large investments, were led by PIs from these two provinces. Geography is based on province of the nominated PI and does not capture projects that are multi-jurisdictional.

Trainees

Although most trainees are supported from diverse sources like provincial or institutional programs, internships or operating grants, a small group of trainees receive awards through the grant peer-review process. The investment in trainee awards grew for both national and regional funders over the three time periods. 2,233 trainees received awards for early translational research projects over the 15 years.

Investment by Modality

For all modalities, there were significant increases in the investment from 2005 levels, although they each had unique patterns in terms of peak investments. Across the board, much of the increased investment was in the pre-clinical phase. The largest investment in terms of major initiatives was for interventive modalities, with much of this investment focused on research on agents (drugs and biologics) and immunotherapies.

Investment by Cancer Site

Breast cancer research represented over 20% of the total site-specific early translational research investment over the 15-year period. The largest increased investments from 2005–09 to 2015–19 were for research relevant to leukemias, and brain, breast, prostate, pancreatic and ovarian cancers.

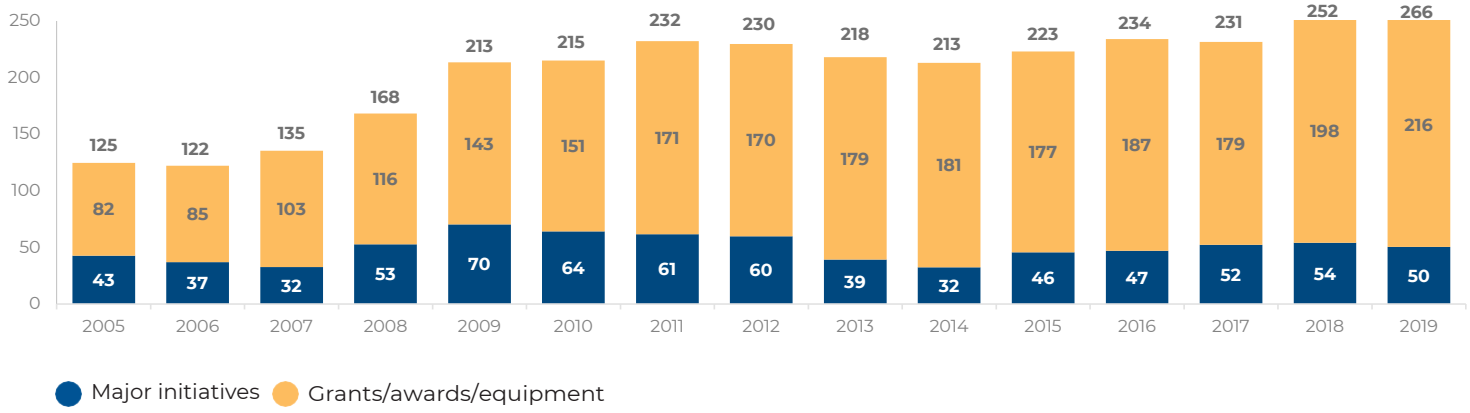
Researchers

There were 1,080 PIs with at least one or more operating grant, career award, or equipment grant in the 2015–19 period that was classified as early translational. More than 60% of these researchers were doing research on new drugs, including immunotherapies.

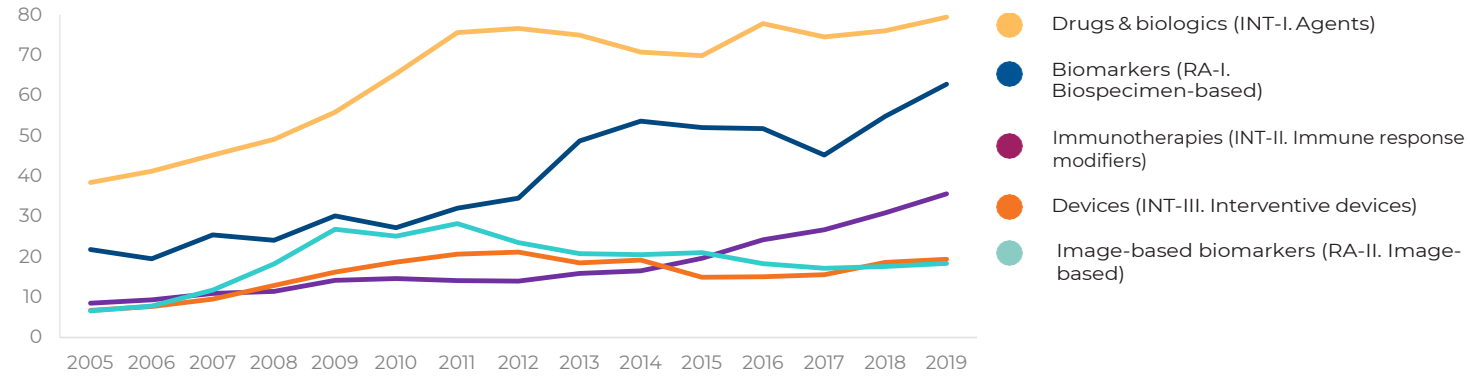
Biorepositories

Biorepositories were not included in the investment figures. They are essential for biomedical research and critical to the advancement of precision medicine. Over the 15 years, many funders invested in the establishment of biorepositories – both national and regional – as well as standard-setting networks such as the Canadian Tissue Repository Network (CTRNet).

Annual Investment ($M)



Investment by Modality ($M)

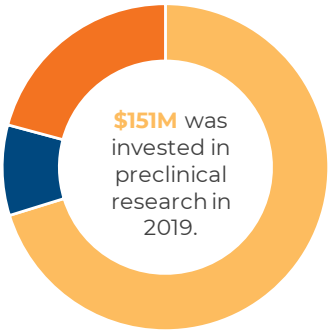


Investment by Funder* ($M)

FUNDER	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CIHR	21	24	25	26	28	32	35	36	39	38	38	41	42	47	55
OICR	11	9	12	18	29	24	27	24	24	23	24	29	28	32	32
CCS	10	11	12	12	13	15	17	19	25	31	32	30	27	22	24
TFRI	6	6	7	8	10	11	11	11	12	11	11	12	14	14	14
NSERC	3	3	4	6	8	9	10	9	8	8	8	9	10	10	10
Ontario Ministry of Economic Development, Job Creation and Trade	1	1	3	5	8	8	10	10	7	5	5	4	5	8	7
Canada Research Chairs Program	4	4	5	5	5	5	5	5	6	6	5	5	5	5	5
Alberta Cancer Foundation	1	2	3	6	5	5	5	6	7	7	5	7	5	4	4
Alberta Innovates	2	3	4	6	5	4	5	5	6	8	7	6	4	1	1
Genome Canada	6	4	3	0	0	3	5	6	6	5	4	6	5	4	5
Other	18	18	25	24	32	34	39	38	40	40	37	38	36	50	59

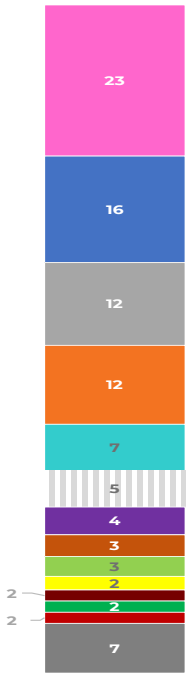
*Excludes major initiatives.

Research Phase (%)



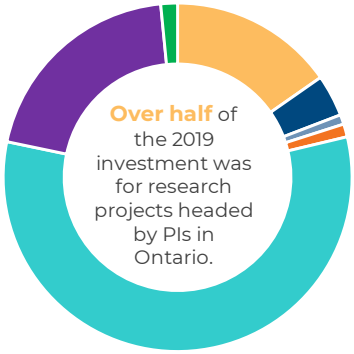
	2015–19	2010–14	2005–09
Pre-clinical	**76**	81	75
Clinical (human research/early trials)	**10**	8	7
Equipment/other	**14**	11	18

Site-specific Investment (%)



	2015–19	2010–14	2005–09
Breast	**21**	24	27
Prostate	**17**	18	13
Brain	**11**	8	6
Leukemias	**12**	13	9
Ovary	**6**	5	4
Lung	**5**	7	9
Pancreas	**4**	2	1
Colorectal	**4**	6	9
Non-Hodgkin lymphoma	**3**	3	3
Bladder	**2**	1	1
Oral	**2**	1	2
Kidney	**1**	1	1
Multiple myeloma	**2**	2	3
Other sites	**9**	8	11

Investment by Province of PI (%)



	2015–19	2010–14	2005–09
British Columbia	**13**	11	15
Alberta	**6**	9	9
Saskatchewan	**1**	1	1
Manitoba	**1**	2	1
Ontario	**57**	61	56
Quebec	**20**	16	15
Atlantic Provinces	**2**	1	2

*The three graphs above represent the 2019 distribution.

CANADIAN PARTNERSHIP AGAINST CANCER
PARTENARIAT CANADIEN CONTRE LE CANCER

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