

Playing in the big leagues

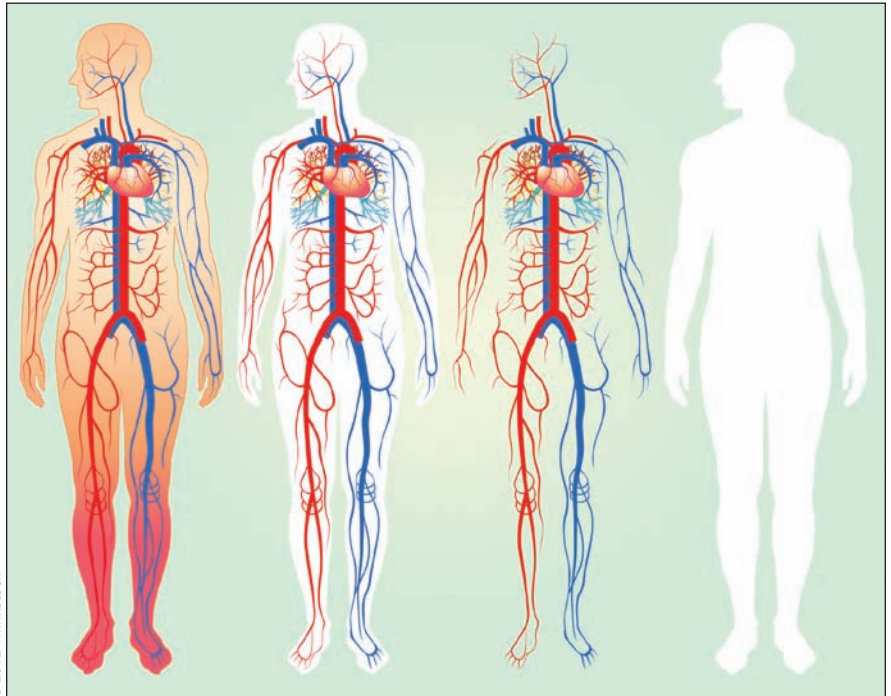
Clinical medicine — particularly dermatology and venereal diseases, and general and internal medicine — along with psychology and cognitive sciences, are among six research fields in which Canada punches above its international weight, according to the Council of Canadian Academies.

The council's assessment, *The State of Science and Technology in Canada, 2012*, also indicates that there are several other biomedical research sub-fields in which the country is among the world's top performers, including anatomy and morphology, areas in which Canada ranks first in the world in terms of Average Relative Citations scores, a bibliometric measure of quality.

Along with clinical medicine and psychology and cognitive sciences, Canada was also cast as a heavyweight in the fields of information and communication technologies, physics and astronomy, historical studies, and the visual and performing arts.

The overall picture indicates that science and technology in Canada is “healthy and growing in both output and impact,” according to an 18-member expert panel appointed by the council, a nonprofit organization that supports information-gathering to guide public policies (www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/sandt_ii/stateofst2012_fullreporten.pdf).

Though home to less than 0.5% of the global population, Canada produces 4.1% of the scientific papers published worldwide — ranking 7th overall, sandwiched between France and Italy. The United States sits high above all other nations, publishing more than a quarter of all scientific papers. The report also states that a survey of roughly 5000 international researchers gave high marks to the quality of Canada's scientific output, with 67% of respondents claiming research from Canada is strong in their fields. Furthermore, 37% said Canadian research was among the



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Anatomy and morphology are among biomedical research sub-fields in which Canada is among the world's top performers.

top five in their fields, putting Canada at fourth place overall in terms of reputation, after the United States, the United Kingdom and Germany.

“Not bad for a country with 33 million people,” says Dr. Eliot Phillipson, chair of the panel and Sir John and Lady Eaton Professor of Medicine Emeritus at the University of Toronto in Ontario. “We are playing in the major leagues, and we are in the premier league.”

But the report wasn't entirely glowing. Some fields aren't performing as well as in the past. Canada's ability to commercialize or develop technologies from research discoveries remains relatively mediocre, while there's a perception among many Canadian researchers that the environment isn't as supportive as it once was.

In comparison with the council's 2006 assessment of Canadian science, “real improvements have occurred in the magnitude and quality of Canadian S&T [science and technology] in sev-

eral fields including Biology, Clinical Medicine, ICT [information and communication technologies], Physics and Astronomy, Psychology and Cognitive Sciences, Public Health and Health Services, and Visual and Performing Arts,” the report states. But there's been a real decline in research in the fields of natural resources and environmental sciences and environmental engineering. In those fields, “the declines that are seen are relative to the world: Canada is making gains in these areas, but not as fast as the world average.”

“In contrast to the nation's strong performance in knowledge generation is its weaker performance in patents and related measures,” the report adds. “Despite producing 4.1 per cent of the world's scientific papers, Canada holds only 1.7 per cent of world patents, and in 2010 had a negative balance of nearly five billion dollars in royalties and licensing revenues.” Meanwhile, the council's survey of Canadian researchers indicated that half believed

the country has lost ground in the past five years.

The findings are invaluable from a policy perspective, Phillipson says. “Every country nowadays does this type of periodic assessment. It’s important to assess this every few years, to see where we are and where we should be going.” The report pegs the most promising emerging areas of S&T as including wireless technologies and networking, information processing and computation, nanotechnologies and carbon nanotubes, digital media technologies, personalized medicine and health care, several energy technologies and tissue engineering.

But overall, Canada’s sterling reputation in the research world bodes well for its future, suggests Phillipson, and will likely lead to greater collaboration with international researchers. Canada’s rates of collaboration are already quite high with other leading nations, including China and Japan. “These collaborations are extremely important because research has become a global enterprise,” he says.

Perhaps the growing respect for Canadian research is one reason more top-tier researchers are coming to Canada. From 1997 to 2010, the country drew more researchers than it lost, particularly in fields such as clinical medicine, engineering and chemistry, states the report. The reversal of the brain drain of previous decades also bodes well for Canada, notes Phillipson. “Ultimately, research is about human capital.”

Within Canada, the four most popu-

lous provinces — Ontario, Quebec, British Columbia and Alberta — account for 97% of scientific papers published, as well as “the best performance in patent-related measures, and the highest per capita number of doctoral graduates.” Other provinces do, however, have pockets of strength in particular areas, including “Agriculture, Fisheries, and Forestry in Prince Edward Island and Manitoba; Historical Studies in New Brunswick; Earth and Environmental Sciences in Newfoundland and Labrador and Nova Scotia; and Biology in Saskatchewan.”

Ontario has the most faculty researchers and the largest scholarly output. The 15 960 faculty researchers in Ontario wrote 182 180 scientific papers from 2005 to 2010, more than double the amount produced by second-place Quebec. Faculty researchers in British Columbia were the most productive, though, with 13.2 publications per researcher over that period, followed by Alberta (12.3) and Ontario (11.4).

The positive picture also stands in stark contrast to the dismal performance in research and development in Canada’s private sector. A new report by the Conference Board of Canada, for example, states that Canada’s weak innovation performance is causing its global competitive ranking to slide (www.conferenceboard.ca/e-library/abstract.aspx?did=5101). In 2010, Canada ranked 10th but has now fallen to 14th place. Other reports released in recent years have also attested to Canada’s lagging innovation.

“Academic-based research is more

important than ever in Canada as a result of the relatively low level of private sector research (compared to other industrialized countries) and the significant cuts to government science by the [Prime Minister Stephen] Harper government,” James Turk, executive director of the Canadian Association of University Teachers, writes in an email. “Canada has an incredibly talented pool of academic scientists and researchers, as well as superb graduate programs training the next generation. The policies currently being followed are demoralizing the scientific community and leading some of our brightest young scholars to pursue their careers elsewhere.”

The council’s assessment of the current state of Canadian scientific affairs was based on a variety of methodologies, including bibliometrics, a bibliometric cluster analysis, technometrics (patent statistics and indicators), as well as surveys of Canadian science and technology experts and of 5154 respondents from more than 40 countries to an email questionnaire submitted to 44 868 of the world’s most cited authors by EKOS Research Associates Inc. “Each recipient was asked to (a) identify their field and sub-field of research, (b) identify the top five countries in the world in their sub-field of research, (c) rate Canada’s overall research strength in their sub-field, and (d) identify any world-leading research facilities or programs in Canada in their field.” — Roger Collier, *CMAJ*

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