THE CURRENT STATUS OF ANAESTHESIA RESEARCH IN CANADA*

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THE ASSOCIATION of Canadian University Departments of Anaesthesia (A.C.U.D.A.) as the official organization representing academic anaesthesia in Canada, through its Research Committee, conducted a detailed survey covering the years 1975/76/77 on the status of funding, manpower and facilities for research in all 16 university departments of anaesthesia. The chairman's report, from which the following was abstracted, was accepted by A.C.U.D.A. as an expression of the Association's view and as a basis for policy planning.

The future of academic anaesthesia and research in anaesthesia is cause for great concern, but especially so in Canada. In mid-1977, about one-third of the university departments of anaesthesia were without permanent leadership. Graduates of residency training programmes are choosing careers mainly outside academic settings and, perhaps most importantly, scholarship within university departments is in many cases becoming increasingly difficult to maintain at levels which would justify the designation "university department". Since the major responsibility of a university is to foster academic excellence through teaching and research, a department which is wholly engaged in the provision of clinical service can hardly qualify as a "university department" even though there may be geographical and historical associations which imply that this is the case.

This extreme situation is far from being only a possibility. Already some departments are perilously close to complete erosion of their academic base and, in at least one case, this lack of university scholarship is complete. While there can be no rational denial of the importance of clinical anaesthesia within the university setting, a balance ought to be upheld to include education and research. Only in this way can the future of a university department be assured as an extant academic entity; otherwise it is surely doomed to failure. The implications for the future of research in anaesthesia are obvious if this trend continues, but even where departments are striving to maintain their academic activities, their efforts in research would seem not to be recognized or to receive adequate support from the various granting agencies. A recent editorial in the Canadian Anaesthetist's Society Journal[1] reported anecdotal statements in relation to the organization of support for research in anaesthesia. These statements by those responsible for agency support clearly suggest that they are prepared to support research in anaesthesia but not research by anaesthetists, thus confirming a lingering suspicion of discrimination in the allocation of research funds. While it is very difficult to obtain accurate data which would substantiate or refute this allegation, such information is available on the extent of funding to anaesthetists or those working in university departments of anaesthesia. This, together with the results of a survey of all 16 departments of anaesthesia on the funds applied for and granted during the last three years, forms the basis of this report.

METHODS

A questionnaire was distributed to each department, completed and checked by departmental chairmen for accuracy. Questions related to manpower, sought information on the number of full-time and part-time specialists and non-specialist anaesthetists, the number of unfilled positions at each rank, the number of members and the percentage of time and hours per week spent in education, clinical service and research. Questions related to research activities included the type of research projects, space and facilities available, extent of technical help and source of funding and number of graduate and postgraduate students in departmental research programs. Also included was a statement of departmental research funds, including amounts and number of grants applied for and granted over the three-year period. Comments were solicited on the areas which should be focussed on as discipline priorities for further research. The format of the

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TABLE I

CURRENT MRC SUPPORT OF RESEARCH IN ANAESTHESIA 1976/77
PERSONNEL AWARDS. Total number, 693; annual budget, $11,147,691; anaesth. $173,730 (1.56%)

Category	Total no.	Total $	Anaesth. no.	% Total	Distribution
Associate	72	2,337,650	0	0	N/A
Scholar	131	2,485,854	2	1.5	McGill (2)
Centennial Fellow	13	276,040	0	0	N/A
Fellow	236	3,760,988	6	2.5	McGill (4) Univ. B.C. (1) U.S. Calif. (1)
Student	187	970,022	0	0	N/A
Visiting Professor	23	15,076	0	0	N/A
Negotiated Development Award	31	1,244,965	1	3.2	U.W. Ont. (1)
TOTAL	693		9	1.3	

TABLE II

CURRENT MRC SUPPORT OF RESEARCH IN ANAESTHESIA 1976/77*
GRANTS IN AID. Total MRC number, 1236.
Total MRC budget, $32,840,907

U. Toronto	3	$78,536 (35.1% anaesth. total)
McGill	3	$42,816 (19.2% anaesth. total)
McMaster	3	$80,926 (36.2% anaesth. total)
Manitoba	2	$ 5,664 (2.5% anaesth. total)
U.B.C.	1	$15,629 (7.0% anaesth. total)
Total Anaesth.	12(0.97%)	$223,571 (0.68% MRC total)

Mean MRC grant value (± 1 S.D.), $25,042 ± 20,097
Mean anaesth. grant value (± 1 S.D.), $18,173 ± 11,275 (72.6% $\bar{m}$ MRC)

*Based on data supplied by MRC where named investigators include anaesthetists not necessarily as principle but excluding those where minor collaboration is mentioned.

questionnaire was designed to allow for numerical data extraction and statistical analysis.

The conclusions reached and the figures quoted were derived entirely from survey data.

Funding of research in anaesthesia in Canada

The principal sources of funds to support research in anaesthesia are the Medical Research Council of Canada (MRC), Canadian and Provincial Heart Foundations, Canadian and Provincial Lung Associations, pharmaceutical industry, university funds and hospital endowments and funds from various local foundations and societies. The MRC provides about two-thirds of all funds available for research in anaesthesia. The annual budget for 1976/77 was $50,848,000. Salary support to investigators was provided to 693 individuals, of whom only nine were anaesthetists, or 1.3 per cent of the total. However, it is noteworthy that 67 per cent of these awards were made to individuals at one university and were mostly at the junior investigator level (Table I). In the grants program a similar situation arose, where, out of a total of 1236 grants awarded for a total amount of $32,840,907, only 12 grants were made to anaesthetists or 0.97 per cent of the total, for a total of $223,571 or 0.68 per cent of the total (Table II).

The overall mean grant value for 1976/77 was $25,042 ± 20,097, while for those awarded to anaesthetists the mean value was $18,173 ± 11,275, which is only 72.6 per cent of the overall mean. No data are available for the total number of grants applied for from all sources to the MRC,

but accurate data are available on the total number and amount applied for from university anaesthetists to all funding agencies, for the year 1976/76. A total of 72 grants were applied for in that year, of which 48 were submitted to the MRC, (67 per cent of the total) but representing 81 per cent ($805,140) of the total funds applied for ($994,000). The number awarded was 11 (23 per cent) for grants totalling $189,000 (19 per cent), whereas of the remaining 24 grants applied for to other sources only one did not receive funding.

This is to be compared with a recent study of research funding in the United States (U.S.)[2] which showed that the total National Institute of Health (N.I.H.) support through the National Institutes of General Medical Sciences (N.I.G.M.S.) was $4,458,000 for anaesthesia out of a total budget of $135,573,000. Thus 3.29 per cent of the total funds were available for research in anaesthesia compared with 0.66 per cent by the MRC in 1976/77. Further, the N.I.G.M.S. awarded career investigatorships to anaesthetists equal to 2.5 per cent of all full-time university anaesthetists, compared to 1.3 per cent in Canada. It is clear from this study that research support is much more broadly based in the U.S. both in a geographic sense and in the type of project material. A notable feature of research support by the MRC in Canada is that only five universities are represented while 90.2 per cent of funds awarded were held in three departments, but this equals only 41 per cent of all Canadian anaesthetists in research (Figure 1).

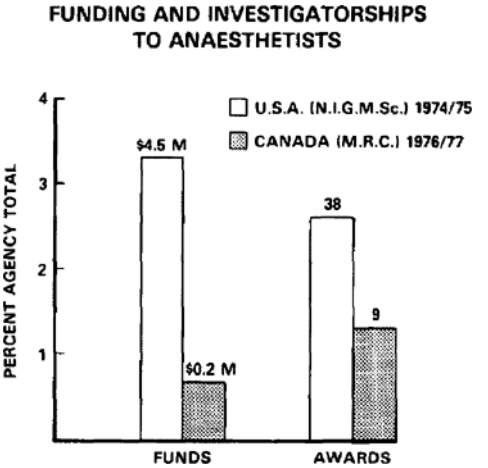

FIGURE 1. Comparison of National Institutes of General Medical Sciences Support in Anaesthesia in 1974/75 with the Canadian Medical Research Council, for 1976/77. Funds are for operating grants, while awards are for salary support of researchers. The figure above each bar is the absolute number of funds and awards in each case.

Canadian manpower in research in anaesthesia

In 1976 the total number of certified anaesthetists was 1373 (equivalent qualified specialists included i.e. those with higher anaesthesia qualifications) of whom 131 (9.5 per cent) had full time university appointments and 504 (36.7 per cent) had part-time university appointments, giving a total of 635 Canadian academic anaesthetists. The average number of full-time facuty per medical school was therefore 8.2 compared with 15.2 in the U.S.[3] The total number of specialist anaesthetists in the U.S. in 1975 was 11,853 of whom 1522 (13 per cent) were full-time in university appointments. In terms of population ratios in the U.S., specialists in anaesthesia were 1:18,560 while full-time university anaesthetists were 1:146,667, compared with 1:16,023 and 1:167,938 respectively in Canada. In 1972/73 the American Medical Association Annual Report on Medical Education[4] showed that there were 1176 full-time anaesthetists or 10.3 per medical school in the U.S. whereas the Canadian Anaesthetists' Society Working Party on Manpower 1972/73[5] found only 99 full-time anaesthetists in the 16 medical schools in Canada or 6.2 per medical school. Thus in the last four years only 32 anaesthetists have joined the ranks of university departments in Canada, representing a 24 per cent increase, while in the U.S. there has been an increase of 346 full-time anaesthetists over a three-year period, an increase of 29 per cent. The optimum number of full-time anaesthesia faculty per medical school of 400 students in a 500 bed hospital is 18.2[6] and is a target which will likely be achieved before 1980 in the U.S., but at current rates will never be achieved in Canada (Figure 2). This shortfall applies equally to the specialty of anaesthesia generally.[7]

As a preliminary to consideration of manpower in research in anaesthesia, a summary of the various commitments of academic anaesthetists in Canada is presented and compared with a similar study in the U.S. (Figure 3). The time spent by full-time academic anaesthetists in education, research and clinical practice has been analysed for the 16 Canadian Medical Schools and compared with that reported by Greene[3] for 104 U.S. schools. Clinical service occupied 30 per cent of an average 50-hour work week for U.S. academic anaesthetists while in Canada the proportion of

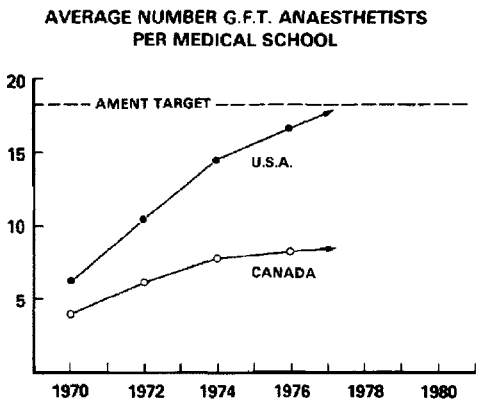

FIGURE 2. Average number of geographic full-time anaesthetists per medical school (16 Canadian and 104 U.S. Schools). The Ament target is taken from reference 6 and is an optimum for an academic department of anaesthesia.

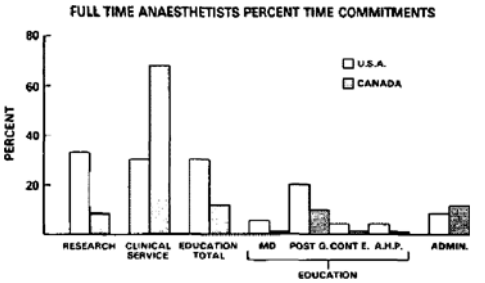

FIGURE 3. Time commitments of full-time academic anaesthetists. Education includes M.D. Undergraduate (M.D.), residency postgraduate (Post G.), continuing education (Cont. E.) and allied health professional (A.H.P.).

time spent in clinical practice was 67 per cent. The total time spent in teaching in the U.S. was 30 per cent compared with 14 per cent in Canada while research time was 32 per cent in the U.S. but only 8 per cent in Canada. Significantly the time spent in administration in Canada was 11 per cent compared with 8 per cent in the U.S. The range of time spent varied greatly between Canadian departments, 41–100 per cent in clinical service, 0–20 per cent in research, 0–33 per cent in education and 0–27 per cent in administration.

The total number of faculty engaged in research in anaesthesia in Canada was 51 (38.9 per cent of all full-time faculty) compared to 960 (64 per cent full-time faculty) in the U.S. The respective averages for researchers per medical school were 3.2 in Canada and 9.0 in the U.S. In the U.S. 547 (36.5 per cent full-time faculty) spent more

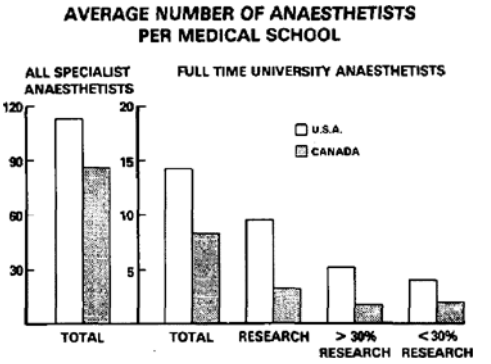

FIGURE 4. The average number of anaesthetists per medical school. The total number of all specialist anaesthetists expressed as per medical school is shown on the left, while the number of specialists who are full-time members of academic or university departments is shown on the right. Those engaged in research are expressed as totals, with those spending more and less than 30 per cent of their time in research, indicated.

than 30 per cent of their time in research compared with 24 (18.3 per cent full-time faculty) in Canada. Thus the average number of researchers having a major time commitment to research was 5.1 per U.S. medical school compared with 1.5 per Canadian medical school (Figure 4).

The number of researchers spending less than 30 per cent of their time in research was 413 in the U.S. and 27 in Canada, or 27.5 per cent and 20.6 per cent of full-time faculty respectively, and 3.9 and 1.7 per medical school respectively.

Thus there were 46 per cent fewer full-time anaesthetists per medical school in Canada and 64 per cent fewer researchers compared to the U.S. but only 23 per cent fewer specialist anaesthetists overall per medical school.

Manpower requirements for research in anaesthesia

On the basis of Ament's calculations[6] some 18.2 full-time academic anaesthetists per medical school would seem to be an optimum to meet the educational, research and clinical service responsibilities of a university department of anaesthesia. In Canada there is thus a comparable requirement for 291 full-time academic anaesthetists. Since approximately 64 per cent of these should be engaged in research, there is a need for 186 active researchers in anaesthesia of which some 36.5 per cent or 106 should spend more than 30 per cent of their time in research. Since currently there are only 131 full-time academic anaesthetists in Canada, 55 new appointees must

be found to match the quotas already planned for in the U.S. However, since only 51 of current encumbents in Canadian University Departments engage in any research, to meet the 106 required all new appointees would have to be researchers with a major time commitment to research (Figure 2).

Given that by the year 1981 there will be a shortage of about 20 per cent of the required number of specialist anaesthetists in Canada[7] as well as in regions such as Ontario which are believed generally, albeit erroneously, to be overdoctored,[8] the outlook is indeed bleak for any significant recruitment to academic anaesthesia and, in particular, to research in anaesthesia. Universities and governments, whether provincial or federal, are unsympathetic to the idea of unilateral increases in the quotas for university departments of anaesthesia. There is even serious consideration being given to reducing residency training positions to balance budgets. Nevertheless, the current situation has gone beyond the tolerable and clearly for anaesthesia to survive in Canadian universities into the 1980s a major effort must be made to obtain support for the academic pursuits of its present and future members.

Academic anaesthesia: a problem of image

Sir William Osler is reputed to have observed that "professors may be divided into four classes. There is first the man who can think, but who has neither tongue nor technique ... a second variety is the phonographic professor who can talk, but who can neither think nor work ... a third is the man who has technique, but who can neither talk nor think; a fourth is the rare professor who can do all three, think, talk, and work." One could probably find examples from each of Osler's classes of professor in Canadian university departments of anaesthesia today, but one believes that the numbers in his fourth class are much greater than is generally realized. However, without support and recognition, there is little doubt that they will soon become the rarity that Osler believed. In an address during his inauguration as President at Harvard University in 1909, A.L. Lowell[3] said: "Productive scholarship is the shyest of flowers. It comes not with observation, may not bloom even under the most careful nurture, but American universities must do their utmost to cultivate it, by planting the best seed, letting the sun shine upon it and taking care that, in our land of rank growth, it is not choked by the thorns of administrative routine." This could apply equally to the plight of academic anaesthesia in Canada at the present time. Part of the current problem lies in a widespread ignorance of what anaesthesia is and what constitutes academic anaesthesia.

Greene[3] defines academic anaesthesiology as "the generation and transmission of knowledge by scholars with a common interest in normal and abnormal biological function, especially abnormal function produced by factors other than by disease". He draws the distinction between an aesthetist who may or may not be an M.D. and who is a practitioner of clinical anaesthesia and an anaesthesiologist who is always an M.D. and who is an expert in the science of anaesthesiology. To a certain extent this has only led to further confusion since in the U.S. clinical practitioners who are M.D.'s are by common practice referred to as anaesthesiologists. In Canada and throughout the rest of the Western world all medical specialist practitioners of anaesthesia, whether they be associated with a university department or not, are referred to as anaesthetists.

The main reason for the rather vague and inconsistent notion which most universities have about anaesthesia and which, unfortunately, many outside groups hold as well, is that the discipline is oriented horizontally. No difficulty is found in universities in recognizing the traditional medical disciplines such as surgery, paediatrics, obstetrics and gynaecology, or even some of the newer disciplines such as immunology and oncology, since these are oriented within clearly defined vertical boundaries, related to modes of therapy, age, sex, disease process, or disease entity. Anaesthesia as a discipline crosses many boundaries: internal medicine and its subspecialties, pharmacology, physiology, anatomy and others, and in the process loses clarity of identity, except to its members. The view commonly held by other physicians and especially by those engaged in surgical practice is that anaesthesia is, by definition, the rendering of a patient insensible and an anaesthetist the person who practices that act.

The same problem of identity bedevils the anaesthetist researcher whose work may be in the field of pharmacology, physiology, biochemistry, cell biology, or in more comfortable areas (comfortable at least to one's colleagues) such as techniques of pain therapy, testing new anaesthetic agents and so on.

In a situation where members of a community proclaim the need for recognition and support of their activity, resistance to arguments to legislate

new or additional resources is felt most acutely, unless these are seen to fulfill a societal need. Actuarially the contribution of anaesthesia research to reduction of the disease burden of society has been of questionable value. Operative mortality and morbidity from haemorrhage, infection and so on have been reduced to negligible proportions, especially for minor procedures. No parallel decrease has occurred in terms of anaesthetic risk. Patients rarely die of surgical complications of such procedures as tonsillectomy, hernia repair or appendectomy, but they do continue to die as a result of anaesthetics. Indeed there has been a steady increase in the total number of anaesthetic-related deaths throughout the years since the first recorded death in Canada due to anaesthesia on February 1, 1858, when Mr. John McChesney died suddenly after a chloroform anaesthetic in the operating room of Dr. French in Montreal.[9] The fact that death rates as a percentage of total anaesthetics administered have fallen dramatically is small comfort to a discipline committed to excellence and safety. A recent study[10] of deaths associated with surgery and anaesthesia in Ontario for 1973 showed that death rates expressed per 10,000 procedures were 0.4 for tonsillectomy, 10.9 for appendectomy, 21.9 for herniorrhapy and 61.9 for cholecysectomy.

One hears from the medical directors of drug companies that funding anaesthetists to do research is a bad risk. This attitude is certainly held by some members of the scientific committees of granting agencies, so that discrimination in terms of funding support is not surprising. Faced with a climate of frustration, in an environment where some studies which are badly designed and controlled are nevertheless published and tagged "anaesthesia research", the serious researcher usually seeks subtle dissociation, at least in his choice of journals in which to publish. This, however, merely serves to compound the current crisis in academic anaesthesia. In Canada, the only publication which represents the specialty of anaesthesia is the Canadian Anaesthetists' Society Journal. Unfortunately the C.A.S.J. has not received the active support it should have from Canadian anaesthetists in research. Indeed, it is apparent that it has attained greater recognition outside Canada than within, as evidenced by the increasing number of contributions by foreign researchers. An international content benefits the journal but to maintain its position as the venue of expression of Canadian anaesthesia, more active participation by Canadian researchers is needed. Recognizing this, the Research Committee of A.C.U.D.A. has resolved through its representatives from each of the 16 Canadian Medical Schools "to encourage all members of the University Departments of Anaesthesia to more actively support the Journal."

The future: a long-term solution

Research in anaesthesia, as in any science, can take many forms, but meritorious research has two fundamental prerequisites: originality in problem definition and knowledge and ability for problem solution. This is equally true of clinical research involving patients as of studies performed in the laboratory. Repetitious research is far from being unique to anaesthesia and has little place in the advancement of knowledge. Nevertheless it seems to be the sort most favoured by the pharmaceutical industry, when seeking approval for release of new drugs in Canada. Almost without exception the release of anaesthetic agents in Canada post-dates extensive clinical trials in the U.S. or Europe. These are repeated here usually on a very limited scale and, it seems, often merely to obtain local respectability. If the practice of anaesthesia in Canada is to continue to improve and the risks to our patients to decline, original research must be actively supported by hospitals, universities, governments, granting agencies and drug companies.

As a general rule, good research is carried out by individuals who have had special training, even though much of their daily life may be spent in clinical practice. The urgent need for knowledge of the mechanisms of the anaesthetic state and the ways in which this affects normal biological functions, as well as the need to develop newer and safer means of achieving it, is obvious. On the other hand, the complexity and sophistication of current methodologies are too great to permit public funds and corporate effort to be expended on journeyman research in the vain hope that this will provide their solution. Advanced training in research with a proven record in the field are virtually a *sine qua non* in today's competitive research market place, but these are no substitute for original thought and the ability to communicate it.

Support by way of long-term secured funding was the means by which N.I.G.M.S. established a number of centres for research in anaesthesia in the U.S. These have spawned academic activities on a widespread scale and are now largely self-supporting. In Canada, individual effort and support through grants in aid are likely to continue as

the predominant feature of research in anaesthesia. It is, therefore, all the more important that anaesthetists who are researchers of Osler's fourth class, who can think and talk, are given every opportunity to work. At the same time, fiscal consideration needs to be given to establishing research activities in all Canadian University departments of anaesthesia so that each may fulfill its scholarly requirement as a university department.

The following are recommendations made by the Research Committee of A.C.U.D.A. as a long-term solution to meet the needs of academic anaesthesia, particularly research in anaesthesia, in Canada:

1. Establish training programmes in research in all Canadian University departments of anaesthesia.
2. Establish the discipline of anaesthesia as a developmental area with special priorities for support.
3. Increase the number and support of career investigators geographically.
4. Maintain stable funding for existing reputable investigators.
5. Establish research priorities within the disciplines of anaesthesia.
6. Maintain a continuing high standard and support for the Canadian Anaesthetists' Society Journal as the medium of expression for academic anaesthesia in Canada.
7. Promote the wider recognition of A.C.U.D.A. as representing academic anaesthesia in Canada.

It is clear that to achieve these goals discussion must take place at many levels, both local and national. The Canadian Anaesthetists' Society, A.C.U.D.A., and the Royal College of Physicians of Canada have different areas of responsibility but a common goal, which is to promote excellence in the practice and science of anaesthesia. Formal recognition by granting agencies of the special difficulties which currently face Canadian academic anaesthetists generally, is an urgent need, but fiscal policy will have to be enacted by universities and governments before any long-term solution is achieved.

Summary

The Association of Canadian University Departments of Anaesthesia (A.C.U.D.A.) surveyed all 16 university departments during 1975/76/77, to obtain detailed and accurate information on manpower and research activities. The results of this survey have been summarized and show that only 0.68 per cent of federal MRC funds support anaesthesia research compared with 3.29 per cent of the U.S. federal N.I.G.M.S. funds. Notably 90 per cent of Canadian research funds are held in three departments. Canadian academic anaesthetists spend twice as much time in clinical service as their U.S. counterparts and there are 46 per cent fewer full-time faculty and 64 per cent fewer researchers in Canadian departments of Anaesthesia as compared to the U.S. A number of recommendations are made which will be acted upon as a basis for future planning.

Résumé

L'Association Canadienne des Départements Universitaires d'Anesthésie a fait enquête auprès de ses 16 membres au cours des années 1975/76/77, en vue d'obtenir des renseignements aussi précis que possible sur les ressources humaines et financières de la recherche dans nos départements. En résumé, cette enquête démontre qu'à peine 0.68 pour cent des fonds du Conseil de la Recherche Médicale sont assignés à la recherche en anesthésie en comparaison de 3.29 pour cent des ressources comparables (mutatis mutandis) qui du côté américain sont distribués par le National Institute of General Medical Science.

A noter plus particulièrement que 90 pour cent des fonds canadiens de recherche sont entre les mains de trois départements seulement. Les anesthésistes universitaires canadiens passent deux fois plus de temps aux activités cliniques que leurs collègues américains; les départements universitaires canadiens ont moins (−46 pour cent) de membres plein temps et aussi moins de chercheurs (−64 pour cent) que leurs équivalents américains.

Ce rapport comporte un certain nombre de recommandations à l'adresse des départements universitaires en vue de guider leur action future.

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