

SURGICAL RESEARCH IN CANADA: SYNOPSIS OF A CONSENSUS CONFERENCE

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Canadian surgical research requires careful nurturing if it is to flourish in tomorrow's environment. A consensus conference organized by the Research Development Committee of the Canadian Association of Surgical Chairs has addressed a number of issues to promote Canadian surgical research. This synopsis is a summary of the proceedings of that conference. It reflects on the meaning of surgical science, elements of establishing a successful research program, leadership in surgical science, identification of talented trainees, and the means to make the most of opportunities for funding. The information contained in the synopsis should not only assist departments of surgery and surgical specialty societies but should challenge them to set goals and innovative approaches to plan for strong surgical research in a changing environment.

Il faut appuyer soigneusement la recherche en chirurgie au Canada si l'on veut qu'elle fleurisse dans l'environnement de demain. Une table de concertation organisée par le Comité de développement de la recherche de l'Association canadienne des directeurs des départements de chirurgie a abordé de nombreux enjeux afin de promouvoir la recherche en chirurgie au Canada. Ce sommaire des délibérations de la conférence présente des réflexions sur la signification de la science chirurgicale, les éléments de l'établissement d'un programme de recherche réussi, le leadership en science chirurgicale, l'identification des stagiaires de talent et les moyens de tirer le maximum des possibilités de financement. Les renseignements contenus dans le sommaire devraient non seulement aider les départements de chirurgie et les sociétés de spécialité chirurgicale, mais aussi les mettre au défi de fixer des buts et d'adopter des stratégies novatrices afin de planifier une recherche solide en chirurgie dans un environnement changeant.

Surgical research in Canada has a rich heritage and a bright future. The past has seen major research advances of international and enduring importance created by Canadian surgeons. Notwithstanding the successes of the past and the promise of current investigators, Canadian surgical research requires careful nurturing if it is to flourish in tomorrow's environment. Numerous changes in the surgical investigator's environment will

impact on research. These include trends toward total government salary support for academic surgeons (and the inherent loss of practice-generated funds for research), reduction in government funding of research and pressure to reduce health care costs. Some of these changes may positively influence surgical research. There are at least 3 positive current initiatives: (1) surgeons may take advantage of new awards designed specifically for the de-

velopment of clinician-scientists; (2) surgical specialty societies have begun to foster surgical research through a variety of mechanisms; and (3) surgeons have developed links with pharmaceutical, instrument and device manufacturers for support. Universities of the future need to encourage these links to promote access to research funds, industry expertise and methodology.

The Canadian Association of Surgi-

This Consensus Conference was organized by the Research Development Committee (Dr. C.H. Tator, Chair) of the Canadian Association of Surgical Chairs and held in Toronto, Ont., Sept. 19, 1994

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cal Chairs has made the development of surgical research a major priority and to this end has created the Research Development Committee. The mission of the Research Development Committee is to foster surgical research in Canada by (1) enhancing the prospects of existing surgical scientists, (2) promoting the development of additional surgeon-scientists, (3) enhancing the quality of research in surgery and (4) informing the public about the importance of surgical research.

Our objective in this paper is to present strategies that will assist Canadian departments of surgery and surgical specialty societies in promoting research, including recruitment of talented students and residents into surgical research, developing surgeon-scientist training programs, creating an appropriate environment for surgical investigators, defining roles of surgical specialty societies, and making the most of opportunities for funding from peer-review agencies, industry, the public and grateful supporters. On Sept. 19, 1994, the Consensus Conference on Surgical Research was held in Toronto in conjunction with the annual meeting of the Royal College of Physicians and Surgeons of Canada. The conference disseminated knowledge about methods for enhancing research in Canadian departments of surgery. Approximately 100 participants attended several keynote presentations and then participated in breakout workshops. They were joined by representatives of some of the country's major research granting agencies including the Medical Research Council of Canada (MRC), the National Cancer Institute of Canada, the Arthritis Society, and the Heart and Stroke Foundation of Canada, as well as representatives from pharmaceutical, medical device and instrument manufacturers. A précis of presentations from the consensus conference,

including contributions by recognized leaders in Canadian research, is detailed in the sections that follow.

PROMOTION OF SURGICAL RESEARCH AMONG STUDENTS AND RESIDENTS

Dr. Robert Salter, University of Toronto

Dr. Salter discussed the philosophy and nature of medical research, the teaching of which is essential to attract talented trainees into surgical research disciplines. He defined research as "a systematic investigation or experimental study of some phenomenon directed to the discovery and interpretation of new data through the critical approach of the scientific method." He cited the advantage of research as enabling the surgeon to progress through professional life, by knowing how to do things, and to develop deep personal satisfaction from understanding the theory behind surgical practice. This approach plays a key role in enriching the curriculum for undergraduate education by emphasizing how to learn rather than just learning facts and promotes the discovery of information through curiosity and the experimental method.

In medical schools, factual information is disseminated by teaching about research and results of teachers' research, but a common shortfall is to omit instruction on how to do research. The goals of research training in a university surgical program are: first, to achieve an understanding of biologic processes that advance the treatment of disorders and injuries in man; second, to enrich education as opposed to the mere training of the surgeon; and third, to bridge the gap between practical art and the theoretical science of surgery. Scientists must develop a number of key qualities. They must be

inquisitive, intuitive, incisive, industrious and "international" in the sense that discovery is made available as an international property. These must be combined with integrity, intelligence, imagination, insight, ingenuity and initiative. Since surgery is a science, surgical disciplines lend themselves well to the development of these qualities.

Dr. Salter presented a "cycle of clinically relevant research" to find the solution to an unsolved clinical problem. This cycle has been helpful in educating surgeon-scientists during the past years. Initially, the cycle starts with an unsolved clinical problem. The astute surgeon-scientist recognizes that the secret of success is to ask the correct question, which can be answered by a research protocol. Then follows a detailed review of the scientific literature with the appropriate historical background. Next a hypothesis is formulated. To investigate the hypothesis, the research protocol is planned. Collaboration and funds are sought, and the investigation is conducted. Research data is collected, analysed and interpreted, and valid conclusions are drawn. The data are presented at meetings and published to achieve strong review by qualified peers. Finally, the new knowledge is applied to the original clinical problem. In this cycle of research, one good research cycle often begets another because unsuspected or serendipitous findings stimulate more questions, which enrich ideas for further research.

DEVELOPING A SURGEON-SCIENTIST TRAINING PROGRAM: THE TORONTO MODEL

Dr. Ori Rotstein, University of Toronto

The rationale for the development of a surgical scientist program (SSP) at the University of Toronto was to

fulfil the realization that surgeon-scientists must take new knowledge to the bedside for the benefit of their patients. Dr. Rotstein presented the University of Toronto's SSP model, including entry criteria, process for selection of candidates, benefits of the program and funding mechanisms.

To gain entry to the SSP prospective participants are required first to enter the surgical training program at the University of Toronto; second, to apply for external funding for personal salary support; third, to commit to a minimum of 2 years education in the research setting; and fourth, to register in the Graduate School of the University of Toronto for a graduate degree. Mentors for trainees are required to have an appointment in the Graduate School as a graduate supervisor and evidence for independent scholarly activity with peer-reviewed funding and a track record of training graduate students. Mentors need not necessarily have their primary appointment in the Department of Surgery. The possible foci of research training within the SSP includes fundamental "bench" or clinical research as well as Master's level education in clinical epidemiology or medical education.

Dr. Rotstein emphasized several factors used to identify qualities of individuals selected to receive training within the SSP and the mechanism by which they are guided. At the initial recruitment phase during application to the program, individuals are identified who are perceived to have a potential for research training. A research orientation evening is held to introduce first-year residents to the research programs available. Trainees are oriented to the central focus of research and given opportunities for individual contact with surgeon-scientists. On an annual basis, trainees are provided with opportunities to meet their divisional head, the program director and the director of

research to discuss their ultimate career plans, which may incorporate research training into their clinical training program. Between 1983 and 1993, 107 residents entered the SSP. The number attracted to the SSP increased significantly through the program's profile, proactive promotion of research in the Department of Surgery and involvement of increasing numbers of surgeon-scientists serving as role models.

Benefits of the SSP have been realized for both the department and the trainees. From the departmental standpoint, recruitment of high-quality trainees has been enhanced. The quality of their research has greatly augmented the research productivity of the faculty, and this has brought significant recognition for the department internationally. Advantages to the surgical trainee have been to formulate career choices earlier in training through early exposure to research and early exposure to role models who influence subsequent career choices. Residents who have completed the SSP have espoused the benefits of research, thus enhancing the clinical training structure. SSP graduates have also had great success in obtaining highly competitive funding and support to enter desirable post-fellowship training positions. Finally, the nurturing of basic skills in research has enabled graduates of the SSP to be prepared for intense research training during post-fellowship years. This links future surgeon-scientists to strong positions with opportunities to capture external funding after joining university departments.

Funding for the SSP has come from several sources. Seventy-five percent has come through external sources, including the MRC, subspecialty surgical societies and industry. The remainder derives from hospital-based or divisional sources and departmentally based funds. A small percentage is de-

rived from the MRC. Funding for the SSP continues to be a challenge because of the inequality between salary scales derived from research support and salaries for individuals working in the clinical stream. Furthermore, specialty societies and the MRC do not provide a benefits package. This inequality has been partially addressed by providing benefits packages through the university divisions of surgery. Recognizing that the difference in pay scales is a potential deterrent to attracting trainees into the research, the SSP philosophy has been to make determined efforts to apply to multiple sources for funding, including applications to many surgical subspecialty societies, affiliated medical specialty societies and industry.

CREATING THE ENVIRONMENT FOR THE SURGICAL INVESTIGATOR

Dr. Bernard Langer, University of Toronto

Dr. Langer outlined the difficulties faced by surgeon-scientists during the initiation of their career and identified ways in which departments of surgery could facilitate the success of newly-hired clinician investigators.

When a new surgeon-scientist is recruited to a faculty position, that person must fulfil the dual roles of independent clinician and independent investigator. Combining these roles is extremely difficult. Some of the difficulty results from the large number of primary objectives for the young surgeon-scientist. There may be an expectation to develop a research laboratory according to a defined percentage of time to be spent in research. Then the faculty member has to organize equipping of the laboratory, preparation of grants, capture of research funds and training of research assistants or tech-

nicians. Subsequently, the research must be completed, manuscripts prepared and presentations made at scientific meetings. All this time, there are numerous other demands competing for the individual's time. One of these is a need to generate income through clinical practice. This is especially difficult if the surgeon-scientist is in competitive practice with primarily clinical surgeons. Teaching responsibilities are exceedingly important to the surgeon-scientist to foster his or her visibility as a role model. However, teaching responsibilities need to be assigned with due consideration for other commitments. Finally, junior faculty members should not be overburdened with administrative work, particularly on committees that have peripheral relevance to the laboratory in which they work.

Dr. Langer identified steps that can be taken to address these problems, thereby maximizing the likelihood of success for surgeon-scientists. The primary responsibility for assigning a high priority to research rests with the departmental chair. This sets the tone of support for the surgeon-scientist. Those who also have major supporting roles include the division heads, surgeons-in-chief, research directors, deans and administrators. To visibly elevate research to a high priority, the department should identify research in its mission statement. This should be a recurring theme in recruitment of faculty and persons to leadership positions. It should also be part of the review criteria for staff at every level. A clear commitment of department funds for research promotion is essential in the department's budget. High standards need to be set for research accomplishments, including critical evaluation of research performance, completion of internal reviews, promotion of departmental and divisional research days, and regular reports on research in newsletters and annual re-

ports. The department needs to recognize staff and trainees for successful awards, grants, presentations and publications. To facilitate research, each department of surgery should develop an infrastructure, including the appointment of a research director and a research committee. Research directors need to have a voice in policy-making and to prepare a database for departmental research and data on research grants that are available.

Clinical groups within the department need to eliminate competition between a new surgeon-scientist and those who have been in practice. This involves the creation of practice plans that do not penalize a young surgical-investigator for devoting time to research. Furthermore, plans need to encourage other practitioners to respect the skills of the surgeon-scientist as a clinician so that the surgeon-scientist can also be a good surgeon. Finally, a reward system in the department needs to recognize the importance of research. Such rewards are promotion and appointment of surgeon-scientists to leadership positions. This sends the strong message to all members of the department that research plays a key role in the department's mission.

Dr. Langer concluded his presentation by identifying issues specific to the surgeon-scientist embarking on a research career. First, surgeon-scientists must have trained according to high standards, often meaning at least 3 years in research training. They can be identified early in their medical school career or in residency training. They are individuals who have a high likelihood to grow into future leaders in the field of clinical investigation.

An example of a Canadian program that addresses the need for high standards in research training is the Royal College of Physicians and Surgeons of Canada's clinical investigator pro-

gram. This program aims to integrate at the training levels the activities of research with clinical activity so that at the time of initiating surgical careers individuals will have had experience with the dual clinician-investigator role. A transition phase near the beginning of the academic appointment allows a controlled environment while the surgeon starts clinical practice. It is essential that at the initiation of his or her career the young surgeon have a clear job description, including a written agreement, which is subsequently reviewed by a formal process after a fixed time. To facilitate the trainee's commitments, a surgical chairperson or delegate must ensure that the newly-recruited surgeon-scientist will have available funds, laboratory space, equipment and collaborators to become productive in the first year. An important mechanism for assisting this is to have a mentor system by which an experienced academic surgeon provides guidance for the new faculty member in terms of priority setting and time management.

THE ROLE OF SURGICAL SPECIALTY SOCIETIES IN PROMOTING SURGICAL RESEARCH

Dr. Ernest Sterns, Queen's University, Kingston, Ont.

Dr. Sterns classified the groups of specialty societies that could influence surgical research as outlined in Table I. These societies have a diverse membership, including a mixture of academic and nonacademic surgeons, specialists outside surgical disciplines and lay persons. The disease-specific organizations play a major role in funding which is important to surgical researchers. The influence of surgical societies depends largely on the goals of the or-

ganization and the research interests of its constituent members.

Dr. Sterns reviewed the research role of specialty societies in terms of information dissemination, promotion, facilitation, postgraduate education and funding. Surgical specialty societies, because of their diverse membership, could collect information and develop a national inventory. This could promote successful funding by surgeons by providing information on strengths and weaknesses in competitions for surgical research funds. The information could also be used as a database to promote collaboration with other researchers and technical assistants as well as seeking consultants for peer review. The information could allow surgical societies to make recommendations to local and national agencies regarding directions and priorities for funding. Promotion of research activities by surgeon-members of the societies would identify role models to prospective students and residents who are considering research careers. The public could be made aware of surgical contributions, which would also promote the awareness of the clinical application of biologic principles in surgical science. Because of budgetary constraints, the societies could provide awareness for the importance of fellowships, bursaries and scholarships to

promote surgical investigators and students. Research would be enhanced by organization of a clinical data bank, tissue banks and national research groups, strengthening the impact of interinstitutional research projects and encouraging communication at the national level to share expertise and technology. Postgraduate education could be enhanced by the surgical societies by making recommendations regarding the research component of specialty training, particularly for the new Royal College Clinical Investigator Program. Finally, all specialty societies can play an important role in ensuring appropriate funding for surgical investigation. This is because surgeons are underrepresented on most granting agencies. Societies could ensure that surgeons are appropriately prepared to compete for and be involved in the peer-review process for research funds.

Surgical specialty societies are well positioned to interact with medical schools, the Royal College of Physicians and Surgeons of Canada and fund-raising organizations. Potential benefits to university departments include information for staff recruitment, advice regarding a suitable research environment and help in developing research education. A federation of surgical societies could be formed to lobby funding agencies for

better representation and more adequate funding.

MAKING THE MOST OF OPPORTUNITIES FOR FUNDING FROM PEER-REVIEW AGENCIES

Dr. Henry Friesen, Medical Research Council of Canada

Dr. Friesen discussed ways of maximizing funds available for research rather than optimizing opportunities to access those funds. He reported a surprisingly robust increase in health research expenditures in Canada for the period 1983 to 1993. During this period, there was a 12.9% average annual increase reported by faculties of medicine. What changed during that period was the proportion of funding from different sources. Table II demonstrates the nature of this change. The MRC as a source of funding has declined significantly to the present day total of 24%. Industry funding of research is increasing. More recent data shows that overall funding is currently at Can\$1519 million annually. The relative proportion of funds contributed by different groups include: business enterprise (31%), higher education (21%), the MRC (17%), private nonprofit organizations (12%), provincial (9%), other federal funds (6%) and foreign sources (5%). The dramatic increase in investments by the private sector and the high proportion of industry funding has occurred since the passage of patent legislation, Bills C22 and C91.

Dr. Friesen outlined MRC plans for funding to support health research during the next 5-year period. The first source of MRC funds is the base budget of Can\$240 million, projected at that level for 5 years at Can\$1.2 billion. The second pathway is a network partnership fund with a target of Can\$500 million over 5 years. The

Table I

Specialty Societies That Influence Surgical Research

Type of society	Breadth of membership	Examples
Unispecialty	One surgical specialty	Canadian Orthopaedic Association, Canadian Urological Association, Canadian Association of General Surgeons
Multispecialty	Multiple surgical specialties	Canadian Society of Surgical Oncology
Multidisciplinary	Multiple disciplines, including surgery	Neurosciences, oncology, gastroenterology, transplantation, critical care
Disease-specific	Lay groups, including physicians and surgeons	Diabetes, cancer, heart and stroke, arthritis

major component of this second pathway is an MRC/Pharmaceutical Manufacturers Association of Canada (PMAC) health program. A matching program of funding is derived from 1 part MRC and 4 parts industry funding. A major philosophy is that this source of funding should invest in people and thereby support research personnel. Among the innovative partnership programs have been networks in health research, including the Breast Cancer Research Initiative, the Canadian Genome Program and the JDF International. A third pathway is a commercial investment that results from spinoffs generated by the first 2 pathways. Ideas and products that have commercial potential and applied health opportunities have a target of Can\$300 million during the next 5 years. The MRC will participate with a group seeking to establish a venture capital fund, which will focus on investing in early stage medical discoveries. The MRC will serve as a facilitator and coordinator offering its peer-review process to assist in identifying opportunities for extensive public investment by government in Canadian medical research. This partnership will create wealth and jobs for Canadians. The fourth pathway is the Health Research Fund. This is focussed on health outcomes and population health research. The philosophy is based on the observation that many service sectors

invest between 1% and 2% of their revenue stream in research to maintain their competitive position. The plan is to consider the model in the United Kingdom where the National Health Service has suggested that 1.5% of health care costs should be available for evaluative research. For Canada, \$500 million is a modest goal for a similar fund during the next 5 years.

MRC sources of funding are subject to major government reviews of science and technology expenditure. It is hoped that the MRC base budget will be preserved. However, the MRC attempts to deliver programs through resources that government makes available to MRC. The views of surgeons are important in shaping its policy. These can be registered at various levels by faculty members who may be on the Council and through regional directors who have been appointed at each medical school.

MAKING THE MOST OF OPPORTUNITIES FOR INDUSTRY FUNDING

Dr. G. Ross, Director, PMAC health program

The MRC/PMAC health program is an agreement and association between these 2 bodies, which collectively represent 65 pharmaceutical companies in Canada to fund re-

search. The emphasis is on high-quality research. From the industry's point of view the work should be of high scientific quality with respect to products, and from the academic scientist's point of view, the object is to share and exchange the science with the industrial scientist and obtain funds to support work that proceeds in the university laboratory. The minimum commitment of the pharmaceutical industry over the initial 5 years of the agreement is Can\$200 million. The aim is to secure more of the dollars expended globally by PMAC companies for Canadian research.

Dr. Ross stressed that there are 2 key foundation elements in the approach to a partnership with industry. The first is a solid basis of good science. Simply put, this means that good science leads to good products, which lead to corporate success. In relationships with industry it is equally important to develop hypotheses that explore mechanisms of disease and to develop important clinical or therapeutic questions that can be answered with a defined clinical base. The second foundation element is the need to fit the research interest to the major interest of the company. This is important because a company that is commercially driven is interested in investing where it can have proprietary right and an ability to recoup its investment. Dr. Ross suggested that in approaching the company a concise 5-page letter should be designed to spark the interest of the chief scientific officer. The structure of the letter should work from the philosophy that the investigator's research is a generic commodity that is in oversupply to be packaged in the most optimal means. The letter should be followed with a phone call, an appointment or a meeting. Since companies may wish to restrict information for competitive reasons, it is essential that confidentiality

Table II

Percentage Distribution of Biomedical Research Funds

Source	Year			
	1981/82	1985/86	1989/90	1992/93
Medical Research Council	39.0	37.7	30.2	24.0
Volunteer peer-review agency	18.1	15.8	15.2	14.1
Industry	2.2	3.6	8.3	22.0
Local services	1.7	2.9	5.2	3.9
Can\$, million		386	576	834

agreements be devised and appropriate intellectual property protection be put in place. University intellectual transfer departments are useful to assist in this regard. Finally, Dr. Ross summarized 4 components of a successful relationship with industry: (1) scientific and personal credibility — the investigator must be open and treat the company as a collaborator; (2) infrastructure support — minimum intellectual and physical assets must exist in the laboratory; (3) realistic time lines, budgets and sharing of information — competitive industry thrives upon timely delivery of information and budget; (4) scientific collegiality — pharmaceutical companies employ many senior scientists whose interest in excellence and strong science is identical to those of academic scientists.

In summary, the MRC/PMAC health program intends to promote increased synergy between academic scientists and industry. Peer review of projects by the MRC adds quality assurance. The aim is to help lever increased funding into Canada to enhance the international competitiveness for Canadian biomedical research. The program is uniquely Canadian.

FUNDRAISING FROM THE PUBLIC AND GRATEFUL SUPPORTERS

Dr. Gerald Halbert, Business Consultant and Fundraiser

From his extensive experience in fundraising for several agencies, universities and hospitals, Dr. Halbert provided valuable advice for the participants. He identified the surgeon-scientist as an ideal person with strong attributes and qualities important for fundraising. In particular, the surgeons' experiences in saving lives and providing a better quality of life to pa-

tients constitutes a strong basis for asking the general public to make commitments to a cause.

The first strategy in fundraising is to establish a strong campaign team. Foundations of hospitals should be approached as well as the development office of the university. These organizations can often suggest the best people to become involved in fundraising. A chairperson should be appointed and a mission statement developed for the campaign. Realistic goals must be set for the campaign. For example, the target funding for a chair could be \$2 million and the target for a professorship may be \$1 million. Then, a realistic time frame should be set for the campaign, which may take 1 to 2 years. The duration of payments by contributors should be carefully scheduled since requests for contributions for various other causes are often present. Five-year payouts are particularly helpful for large contributions. The campaign can be marketed by publishing pamphlets containing information. This provides an opportunity for potential donors to think about the information rather than commit the donation immediately. An opening event to kick-off the campaign and a press conference can be helpful ways in marketing the campaign.

The act of canvassing for donations must be carefully planned. A list of potential donors consisting of grateful patients, friends and charitable foundations should be established. There should be careful consideration of the giving patterns, and this can often be achieved by obtaining a history from most hospital foundations and development offices of universities. This history should include the size of past contributions, interests of the organization, and their financial means. The best person to approach particular donors should be carefully considered. The importance of experienced

fundraisers should not be underestimated. A surgeon and a grateful patient may work together as a team approaching potential donors. The fundraisers themselves should demonstrate their solid commitment to the cause by making a personal donation. It is important to build confidence by securing the easiest donations first. For large goals, such as a \$2 million chair, it is helpful to obtain a "lead gift." This is a large contribution that is usually obtained by careful study and research of donor lists. Donors who have the means should be approached with a request for a large lead gift involving, if necessary, the university president or dean of medicine. Canvassing methods that secure major contributions usually require personal and direct contact with donors. Telephone contact, followed by mailing of pamphlets, and then making an appointment to meet a potential donor face-to-face are key elements in the process.

SUMMARIES OF WORKSHOP SESSIONS

Participants at the consensus conference were divided into 3 groups of approximately 30 people each who met for 2 hours. Each group discussed the 3 topics listed below for approximately 40 minutes per topic. Discussion of each topic was led by a facilitator and each topic was summarized by a reporter at the subsequent plenary session. The following summaries are a compilation of the reports of the 3 reporters of each topic.

Roles in creating the environment for surgical research

- Department chair
- Specialty chair
- Surgeon-in-chief
- Hospital or health region CEO

- Department of surgery research committee

- Specialty societies

Surgical research flourishes in an environment in which the leadership establishes a tone or culture in favour of research. The role of the chair is to set a value system within the entire department that cultivates research. Without strong support from the chair, research is not likely to prosper. The role of the chair is developmental and includes quality control and measurement of productivity of the members of the department. The chair can promote research through recruitment of a critical mass of surgical investigators, appointment of appropriate division heads and by means of the promotion process. In many practice settings there is also the possibility for rewarding financially those devoting significant time to research. At the very least, a financial practice plan is essential for the development and promotion of research. The chair can indicate that research is a priority by recruiting surgeon-scientists early in their careers. These recruits need to be selected early, perhaps even in medical school. Development of the infrastructure for research such as a departmental research committee is the responsibility of the chair.

Especially in larger programs, the department chair's role in making research a priority must be shared with the surgeon-in-chief of the university hospital and the specialty chairs or division heads. The responsibility for promoting research through recruitment and promotion is shared with these leaders, some of whom should be specific role models and mentors for young investigators. The surgeon-in-chief may be particularly helpful through influence on the process of allocation of space for research laboratories. The young surgical scientist also depends on the surgeon-in-chief

for block bookings in the operating room and for a reasonable call schedule to make research time as efficient as possible. The division chief should play a role with respect to the case load and subspecialization of the young clinician scientist.

The CEO of the hospital must also be involved in setting the tone in favour of research and can be helpful in a variety of ways, including the provision of start-up funds for surgical investigators and laboratory space. For research to flourish in the hospital setting requires a supportive chain of command and this must begin at the top.

In smaller departments, where a critical mass of investigators cannot be achieved, collaboration with scientists in other departments is an essential ingredient of a supportive environment. Even in large departments, this critical mass may be impossible to achieve in all areas of research, and interdepartmental collaborations may be essential. The chair can be helpful in creating opportunities for collaboration through mechanisms such as cross-appointments. Collaborations with basic science departments are highly desirable. Protection of research time is of overriding importance, and the leadership at all levels must take responsibility for ensuring adequate research time for surgeon-scientists. Nonclinician scientists often spend 75% or more of their time in research; thus, it is unlikely that clinician-scientists can be competitive for peer-review grants if they spend significantly less time in research. The one exception may be clinical research in which a surgeon-scientist uses his or her clinical practice as the research environment. Also, epidemiologic or outcomes clinical research may require less research time commitment, especially when there is adequate statistical support. The hospital division head should help select the best method of time protection

from a number of possible formats. For example, specific days per week or weeks per month may be designated for research with or without a job-sharing arrangement with one or more other surgeon-scientists.

It was clear from the workshop discussions that individual, competitive, financially unrestricted private practice is incompatible with the academic goals of the departments of surgery, and that income guarantees and income limitations are highly desirable.

The ideal surgical research environment will vary greatly from one location to another. Often it is possible to examine successful models in other departments in a particular university to find the unique ingredients contributing to success. For example, departments will have varying potential for industrial links depending on the needs of the particular industries located nearby and on the nature of the patient population that can be mobilized for clinical trials.

It is acknowledged that the first few years of a young surgeon-scientist's career are the most important, and during this time the leadership must be most active in creating the right environment. Appointment of a mentor, financial help with start-up funds or provision of bridge funding when a grant application to an external agency fails, and the establishment of an internal review process, are other important measures to enhance the environment for young surgical investigators.

Sources of surgical research funding

- External peer-review agencies
- Grateful patients
- Industry
- Specialty societies

To improve the success rate for obtaining funding from peer-review agencies, it is essential for departments

to develop strategies to improve the quality of the grant applications submitted. The strategies should include provision of a mentor such as a senior scientist to guide the younger applicant, especially during the first 3 to 5 years. All departments of surgery should have an internal review process for grant applications to external agencies. The internal review of applications provides critical feedback to the young investigator and to the seasoned investigator with funding difficulties before submission of applications to external agencies. At either the grant-writing stage or at the stage of internal review, important collaborations can be suggested. The internal review process should involve reviewers from other departments, especially basic science departments. With unsuccessful grants, the internal review committee should be involved in analysing the reviews from the external agencies, using these reviews to improve the reapplication and suggesting alternative agencies or other means of support.

Surgical representation on the review committees of many agencies is minimal or nonexistent. There is a general feeling among surgeons that the rate of successful funding from certain agencies would increase if more surgeons were involved in the peer-review process. Some agencies cite unwillingness on the part of surgeons to spend the time on review panels or inadequate performance of those recruited. The departments of surgery must encourage their members to serve and to perform in an exemplary fashion if given the opportunity. The chairs must be active in suggesting names of surgeons for inclusion on peer-review agency panels. Unfortunately, some agencies interact only with the faculty's research director and not directly with departments of surgery, and thus, the surgical chairs

must be active in presenting surgeons' names to the faculty research director for transmission to these agencies.

It would be highly desirable for departments to have some discretionary funds available for young investigators as seed money for new or pilot projects. The submission of pilot data with a grant application is an important strategy for reassuring the reviewers at peer-review grant agencies of the feasibility and likelihood of successful completion of a project. Seed money for pilot projects can sometimes be obtained from specialty societies or industry.

Departments of surgery have a major advantage over some departments in having many faculty in direct contact with patients who are potential donors. Indeed, every department of surgery is probably capable of obtaining funds from grateful patients for at least one endowed research chair. The fundraising potential of surgeons can be enhanced by working with professional fundraisers who are already in place at almost every hospital or university. Donors of large sums develop a level of confidence from communication with foundation or development staff at hospitals or universities.

One strategy for obtaining funding from industry is for surgeon-scientists to consider the marketability of their products, techniques or ideas. There is no place for an ivory tower mentality among university surgeons. All surgeons should be thinking of their intellectual property as a potential profit item for their hospitals and universities, for industry and for themselves. It is important to foster communication between industries and the universities to discuss the needs of these 2 bodies. Most universities and some of the large hospitals have experts to guide the marketing and protection of intellectual property. Indeed, some

have development officers who can bring researchers into contact with venture capital which can be used to enhance the research.

Some provincial ministries of health have recently become interested in outcomes research and are willing to fund this type of research. Surgeons are in an excellent position to participate in this type of research, and even if they do not have the expertise themselves, they can establish effective collaborations with methodologists and epidemiologists. Surgeons who have taken advanced training in clinical epidemiology are ideally suited to conduct or collaborate in this type of research.

Specialty societies can also play an important role in supporting surgical research. Their encouragement and support of resident research through research prizes and fellowships are excellent mechanisms for research promotion. At the staff investigator level, specialty societies promote research by providing staff awards, career scientist awards or operating grants, and by facilitating certain types of research, such as research into practice guidelines and collaborative research between universities.

Research priorities for departments of surgery in Canada

- Can every department of surgery do research?
- Surgeon-scientist training programs
- Basic-science research
- Health care delivery and outcomes research

Surgical research includes research in the basic and clinical science of all the surgical specialty areas and also research in surgical education and outcomes. Each department of surgery should determine its research priorities, because it is not possible for each to do high-quality surgical research in

all these areas. It is necessary to select options according to the staff available for creating a critical mass, available facilities, potential for collaboration and available funding. Every university department of surgery can develop a high-quality surgical research program in at least one area. Small departments can increase the number of areas pursued by strategies such as collaboration with other departments at the same university or with departments of surgery at other universities. However, a fundamental prerequisite is that high-quality research training is required for all surgical research,

whether basic science or clinical science. Only if the quality of the research training is high will surgical research compete successfully for grants.

A departmental or divisional financial practice plan that recognizes the importance of each faculty member with respect to teaching, clinical care and research responsibilities is essential for fostering research.

Large departments of surgery should be able to develop a surgical scientist training program to offer formal research training to its residents. However, smaller departments may wish to send some of their trainees to

a surgical scientist training program in another university. Every surgical resident should have the opportunity to have training in research, although it is not necessary for every surgical resident to do research.

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