

**Schulich School of Medicine & Dentistry
Health Research Plan**

*Shaping the Future of Health Care
Through Excellence in Research*

Our Research Mission: 2008-2012

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Executive Summary

The Schulich School of Medicine & Dentistry at The University of Western Ontario is recognized for its research strength that is based on internationally renowned, high-calibre faculty in specific areas of research, well-established core facilities with city-wide partnerships and governance, and an excellent environment for students and trainees.

Schulich Medicine & Dentistry believes that further strengthening of its research is dependent on the calibre of its faculty and trainees. Thus, Schulich has recruited and retained strong researchers and trainees using federal and provincial funding mechanisms. In addition, Schulich Medicine & Dentistry is one of the “four pillars” of the new Western fundraising campaign and will fully participate to accrue new endowments and resources to ensure that more excellent researchers continue to be recruited and retained.

The School has identified seven Areas of Research Excellence based on sustained excellence in research productivity, leadership and innovation, and recognition at national and international levels. These are: *Biomedical Imaging Research; Cancer; Cardiovascular, Respiratory Health, and Metabolic Diseases; Maternal, Fetal, Child and Family Health; Infection and Immunity; Musculoskeletal Health; and Neuroscience and Mental Health* (See Appendix A). Significantly, Schulich researchers play a primary role in two of Western’s signature research areas: *Imaging and Neuroscience/Brain & Mind*.

Seven emerging areas of research strength that show strong potential to develop into areas of excellence have also been identified. These areas are increasingly becoming foci for researchers, with expanding opportunities for research and resources. These areas are: *Aging and Geriatric Medicine; Clinical Pharmacology and Personalized Medicine; Environment and Health; Genomics, Proteomics and Bioinformatics; Health Services, Delivery and Policy; Innovative Surgical Therapies; and Population Health* (See Appendix A). Areas of research excellence and emerging areas of research strength will be priority areas for future investment of Schulich Medicine & Dentistry resources.

The research strength of Schulich Medicine & Dentistry also lies in the availability of core facilities and major equipment to its faculty. The School has made major investments in developing and sustaining state-of-the-art platform technologies and core facilities to enable faculty to have access to, and utilize, cutting-edge research tools for their research. The governance of these facilities has occurred in partnership with the University and its affiliated research institutes. This partnership is a key element in the establishment and maintenance of vital core facilities. Schulich Medicine & Dentistry will contribute funds towards the operation and maintenance of the facilities through this partnership. It will also strongly support the acquisition of new infrastructure through competitive funding from national and provincial funding sources, and will invest resources to keep facilities current and appropriately resourced.

The productivity and innovation of Schulich faculty are significantly enhanced when they work collaboratively in an interdisciplinary manner. The School will collaborate and

coordinate its space planning and development with the University and its affiliated research institutes. New space for Schulich researchers will be organized on a thematic or programmatic basis. Schulich Medicine & Dentistry will establish a strategic building and renovation plan for the next decade that will allow its faculty to conduct cutting-edge and innovative research in coordination with its teaching mission. It will embark on a fundraising campaign focused on innovative research and teaching to realize this goal..

Through the actions outlined in this Plan, Schulich Medicine & Dentistry will:

- Increase the number of faculty with external peer-reviewed research funding and aim to become one of the top medical and dental schools in the country with most grant funds per capita faculty.
- Increase the ratio of PhD students to Masters students within the overall graduate student population of Schulich.
- Increase the numbers of graduate students and postdoctoral fellows with external scholarships.
- Increase the number of medicine and dentistry undergraduate students involved in research and aim to become the top medical and dental schools in the country with highest participation and productive medical and dental students in research.
- Increase the number of clinician scientists and clinician researchers obtaining external salary and research support, and aim to become one of the top medical and dental schools in the country with the highest ratio of clinician scientists among clinical faculty.
- Ensure that its core facilities become financially stable.
- Increase interactions and collaborations with partner universities in Southwestern Ontario to achieve research findings that will improve health of the people of the region, and of all Canadians.

With strong and motivated faculty, trainees and staff who believe research is an essential fabric of their academic mission; with well established state-of-the-art research infrastructure and core facilities that are developed and sustained collaboratively among its partners; and with a cohesive Health Research Plan, the Schulich School of Medicine & Dentistry aims to become one of the top biomedical research institutions in Canada and the world.

Introduction

The Schulich School of Medicine & Dentistry is recognized for its research strengths that include internationally renowned, high-calibre faculty, well-established core facilities with city-wide partnership and governance (see **Appendix C**), excellent research groups and centres (see **Appendix D**) and the administration of large scale multi-centre clinical trials. The School offers an excellent training environment with new interdisciplinary programs at the undergraduate and graduate levels.

Schulich Medicine & Dentistry (formerly the Faculty of Medicine & Dentistry) developed its initial Health Research Plan in 1999-2000. The Plan was developed through a widely consultative process and has been used as the basis for internal decisions related to research priorities and for allocation of resources such as Canada Research Chairs (see **Appendix E**). Since the initial Health Research Plan was implemented, there have been important advances within the Schulich research community including a record recruitment of top-ranked researchers at all career stages, establishment of world-class core facilities due, in part, to substantial success in attracting large infrastructure grants from national and provincial funding agencies, and a considerable expansion of high-quality research space in multiple sites across London.

In 2005, an External Review Committee evaluated Schulich Medicine & Dentistry's activities with respect to the Plan, and made recommendations to improve the School's progress towards its research goals.

In 2006, Schulich Medicine & Dentistry issued *Shaping the Future of Health Care*, its Academic Plan and Strategic Directions for 2006-2010. This document identified directions and goals necessary for the School to fulfill its academic mandate. One of these strategic directions, "Enhance our research capability, productivity and impact," directly addresses the research mission of the School. However, research activities of the School are embedded throughout its programs, and therefore, all of the strategic directions have direct or indirect implications on the future direction of research at Schulich. The strategic directions and the associated goals related to research are listed in **Appendix F**.

Western's Strategic Plan, *Engaging the Future*, affirms Western's objective to maintain and enhance its stature as a leading Canadian research intensive university through:

- strategic investment in areas of established and emerging research strength.
- attention to faculty recruitment and retention.
- emphasis on graduate programs and enrolment, and recruitment of postdoctoral fellows.
- construction and renovation of appropriate space.

Western's new Strategic Research Plan, released in 2008, establishes a proactive template for supporting both the culture and the practice of research at Western through the selection of key areas for research focus. It also outlines the establishment of appropriate

structure and resources for maintaining and advancing Western's position as one of Canada's premiere research-intensive universities. Its primary objectives are to:

- Identify specific areas of existing and potential research strength at Western.
- Assist the recruitment, training and retention of highly qualified faculty, students, postdoctoral fellows and staff at Western, and ensure that such individuals are able to access the resources required to undertake their research.
- Encourage propagation of the collaborative and interdisciplinary research models required to tackle increasingly sophisticated research issues.
- Provide directions to facilitate the development of infrastructure and services required to promote excellence in research, and to meet specified targets for research performance for Western as compared to other research-intensive universities in Canada.
- Promote opportunities for researchers to transfer the knowledge they have generated to the benefit of Canadians through engagement with community agencies, commercialization of inventions, and other means as appropriate to their discipline.
- Cultivate broader research partnerships in London and Southwestern Ontario, the province, the nation and internationally.

One of the priorities identified in *Shaping the Future of Health Care* was to update the Health Research Plan. This updated Health Research Plan is intended to provide guidance and directions for investment in research for Schulich Medicine & Dentistry for the period 2008-2012.

Developing the new Health Research Plan

In 2007, a Task Force for Revising the Health Research Plan was formed, including members from basic medical science and clinical science departments, Dentistry, Robarts Research Institute and Lawson Health Research Institute. To assist the Task Force, four subcommittees were created to examine specific aspects of the existing Plan:

- Platform Technologies and Core Facilities
- City-wide Linkages with Western Faculties, Hospitals and Affiliated Research Institutes
- Graduate Students and Trainees
- Current and Emerging Themes of Research Excellence

A consultative session was held in November 2007 at which the findings of the subcommittees were presented and discussed. Input was solicited from faculty members, chairs, and research partners both before and after the consultative session and a "town hall" meeting was held to discuss the draft plan. In addition, input was requested via a website and email.

Principles for the Plan

The principles for development of the current Schulich Health Research Plan reflect those originally enunciated in the initial Health Research Plan:

- Research strength is based on the excellence of individual researchers, students and trainees within Schulich.
- The plan includes all researchers within Schulich, whether located on- or off-campus (e.g. researchers at the various campuses of London Health Sciences Centre and St. Joseph's Health Care London).
- Individual researchers working on hypothesis- or discovery-driven projects of very high quality are critical for the further development of health research.

In addition, the following principles identified in *Shaping the Future of Health Care* have been articulated to guide research at the School:

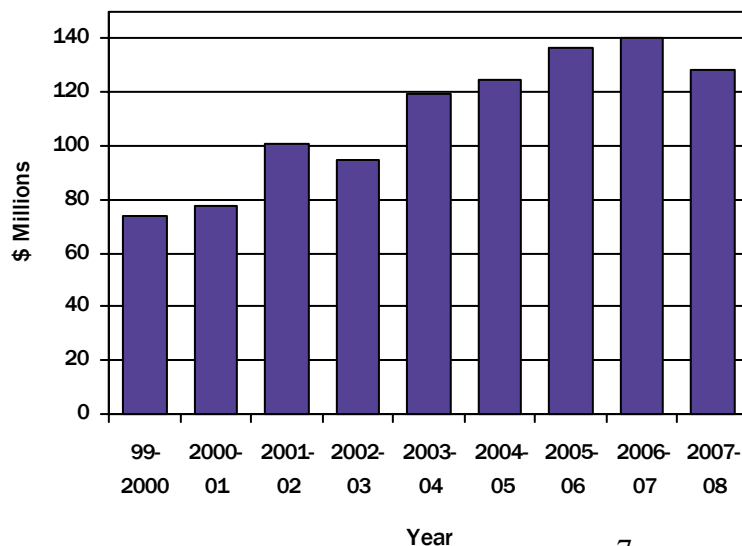
- Research should be woven into the fabric of all of the activities of Schulich Medicine & Dentistry (teaching, care, outreach).
- Investigator-initiated research is the foundation of all research activities; team, trans- and interdisciplinary research are more likely to be successful when applying for strategic research opportunities.
- Improving health requires fundamental and translational research.
- Schulich Medicine & Dentistry should encourage a culture of transdisciplinary research.
- Training of future researchers should be an integral part of all research programs.
- Faculty development is a priority to strengthen research capability and capacity.
- Schulich Medicine & Dentistry should look to leverage opportunities:
 - Take advantage of unique opportunities (regional integration), existing strengths & infrastructure
 - Consider opportunities from all sources (traditional and non-traditional, including industry)
 - Adapt to the changing funding environment, be forward-looking and innovative
 - Pursue knowledge translation or transfer opportunities
 - Capitalize on partnerships
- The School should set goals that are achievable within the time frame of the strategic plan.

Environment for Research

Schulich Medicine & Dentistry is well positioned to take advantage of new and emerging opportunities. The School has been influenced by a number of changes in the external and internal environment for research since the initial Health Research Plan was released in 2000. Positive developments include:

- Recruitment of top-ranked researchers at all career stages.
- Development and establishment of world-class core facilities (e.g. London Regional Genomics Centre; London Regional Proteomics Centre; London Regional Innovarium, London Regional Cell and In Vitro Molecular Imaging Facility), in part due to substantial success in attracting large infrastructure grants including Canada Foundation for Innovation (CFI) awards.
- Expansion of high-quality research space across the city, including renovation of the Medical Sciences Building, construction of the Dental Sciences Addition, and development of research space at the Lawson Health Research Institute (e.g. Victoria Research Laboratories) and the Robarts Research Institute.
- Integration of the Robarts Research Institute within Western, which presents new opportunities for growth.
- Development of linkages with the University of Windsor, resulting from the expansion of the MD program to Windsor, provides opportunities for exploration of common interests.
- Increased partnerships and collaborations within Southwestern Ontario including the establishment of the “Lifecycle Research Network,” a clinical research network in Southwestern Ontario intended to combine the resources of major academic centres, and be a world-class clinical resource for studying and implementing cost-effective advances in health and chronic care.
- Renewed focus on graduate studies, both through expansion of existing programs and the development of new programs (e.g. Developmental Biology).
- Increased funding for research at Schulich Medicine & Dentistry, from approximately \$74 million in 1999-2000 to more than \$128 million in 2007-08.

Summary of Research Funding 2000-2008



- Approximately 32 per cent of research funding is provided by federal agencies and 22 per cent is from Canadian and foreign industry; the balance is provided through provincial funding, Canadian and foreign charitable institutions, local support and internal funding.
- Support from London sources and internal Western sources total more than \$21 million.
- The largest single source of support is the Canadian Institutes of Health Research.
- Schulich researchers account for approximately two thirds of total research funding at Western.

At the same time, there are clear challenges, both internal and external, which will influence Schulich Medicine & Dentistry's future:

- Federal investment in research is increasingly oriented toward applied rather than basic or fundamental research, with a strong emphasis on knowledge translation.
- Changes in provincial and federal government funding programs for research will translate into new programs, new emphases, and new guidelines and requirements for oversight.
- The Canada Research Chairs program, which has been of immense benefit in recruiting and retaining faculty, has reached its capacity; new tools to facilitate recruitment and retention will be needed.
- The demographics of both an aging general population and of university faculty are creating an increasingly competitive market within which Schulich must retain and recruit faculty.
- Advances in research continue to require new infrastructure and facilities, while funds for the operations and maintenance of research facilities are constrained.
- The research laboratories and facilities of some Schulich faculty have been placed in locations that are not optimal for productive research.
- The need for improved research space for some Schulich faculty and research groups.

Areas of Research Excellence

Seven areas of research excellence have been identified within the Schulich School of Medicine & Dentistry. These areas were selected based on factors including sustained research productivity, leadership and innovation of researchers and research groups within each area. These research areas, which have enhanced Schulich Medicine & Dentistry's reputation nationally and internationally, are:

- **Biomedical Imaging**, including researchers in Robarts Imaging Research Laboratories and the Lawson Health Research Institute's Imaging Program, focuses on the discovery and development of innovative imaging techniques and instrumentation to improve the understanding, diagnosis and treatment of human diseases.
- **Cancer**, including researchers based at the London Regional Cancer Program and researchers in basic sciences and research institutes, ranges from fundamental research to research on new and innovative treatments and cures for the various types of cancer, to clinical trials, and features a strong emphasis on translational activities.
- **Cardiovascular, Respiratory Health, and Metabolic Diseases**, includes basic and clinical research on a range of topics areas such as atherosclerosis, cardiac valve biology, vascular biology, vascular imaging, sepsis, inflammatory lung diseases and diabetes.

- **Infection and Immunity** includes immunopathogenesis of type 1 diabetes and transplantation, chronic inflammation, immunoregulation, innate immunity, infectious diseases and probiotics.
- **Maternal, Fetal, Child and Family Health** encompasses research into reproductive, maternal and fetal health, developmental biology, newborn, child, youth and family health occurring at the Children's Health Research Institute, and research on the enhancement of family medicine and primary health care practice occurring at the Centre for Studies in Family Medicine.
- **Musculoskeletal Health** includes researchers in skeletal biology, orthopaedics, rheumatology, dentistry, clinical trials, imaging, rehabilitation and geriatrics, with a major focus in the multidisciplinary CIHR Group in Skeletal Development and Remodeling.
- **Neuroscience and Mental Health** is a broad area with emphases on complex neurological and neuropsychiatric disorders, neuro-imaging, and the effectiveness of existing and new therapies and surgical interventions that may alleviate the symptoms or slow the progression of neurological diseases. Western's Graduate Program in Neuroscience provides a focus for research in these areas.

Highlights of activities in each of these areas are provided in **Appendix A**, and the criteria that were used to identify these areas are listed in **Appendix B**.

Emerging Areas of Research Excellence

Seven emerging areas of research strength have been identified within Schulich Medicine & Dentistry. These emerging areas show strong potential to develop into areas of excellence. These areas are at various stages of development; some already have a strong existing nucleus of research activity within the School, while others currently engage only a few researchers but have specific plans for development and opportunities for growth. These seven areas are:

- **Aging and Geriatric Medicine**, including stroke and cardiac rehabilitation, spinal cord injury, musculoskeletal rehabilitation, chronic pain, geriatric medicine, health services, Alzheimer's disease, quality of life and quality of care, and wound healing.
- **Clinical Pharmacology and Personalized Medicine**, including the new Centre for Clinical Investigation & Therapeutics (CCIT) at the London Health Sciences Centre, one of the first centres of its kind in Canada for bench-to-bedside research and clinical trials.
- **Environment and Health**, including transdisciplinary research on the interrelationships between humans and all aspects of their environment, including disease, health and well-being.

- **Genomics, Proteomics and Bioinformatics**, including research that benefits from the development of the London Regional Genomics Centre and the London Regional Proteomics Centre; and research aimed at developing novel perspectives in computer science, medicine, biology and engineering.
- **Health Services, Delivery and Policy**, featuring research on the enhancement of family medicine and primary health care practice; improving the well-being of persons with serious mental illness by promoting applied research, evaluation and knowledge transfer in mental health services; health economics research on the cost of health interventions; and biostatistical research on cluster randomization methods.
- **Innovative Surgical Therapies**, including minimally invasive and robotic surgery.
- **Population Health**, including research on the determinants of health, causal modelling of disease etiology and research on methods for the design and conduct of epidemiological studies, biostatistical research on methods for analysis of population level data, as well as methods for detection of interaction.

Brief descriptions of activities in each of these areas are provided in **Appendix A**, and the criteria that were used to identify these areas are listed in **Appendix B**.

These Areas of Research Excellence and Emerging Areas of Research Excellence will be priority areas for future investment of Schulich Medicine & Dentistry resources for 2008-2012.

It is important to note that some areas identified in Schulich Medicine & Dentistry's initial Health Research Plan as either "Areas of Research Excellence" or "Emerging Areas" do not appear in this plan. Their omission from the current plan is not intended to minimize the excellence of ongoing research in these areas, but instead reflects a changing and dynamic research environment.

Signature Areas

To enhance its profile in an increasingly competitive educational and research environment, The University of Western Ontario has identified “signature areas” for research. These are areas that bring Western recognition and prominence extending well beyond Canada, and that help to build the reputation of the University both nationally and internationally. Western’s criteria for identifying signature areas include:

- Publication in prestigious journals.
- Attraction of outstanding graduate students or postdoctoral fellows.
- Success in achieving national and international awards and distinctions.
- Attracting a disproportionate number of Canada Research Chairs or other Chairs.
- Achieving unusual success in securing funding for infrastructure, equipment, and/or facilities.

Schulich researchers play a primary role in two of Western’s signature areas:

- **Imaging**, as recognized by international leadership in the use and development of imaging technologies across the disciplinary spectrum, including sophisticated tools used for medical diagnostics, advanced microscopy, materials and historical and anthropological artifacts.
- **Neuroscience/Brain & Mind**, as indicated by internationally recognized research undertaken in a variety of disciplinary areas pivotal to an understanding of the brain, its functioning and health, linking cell biology, brain imaging, and psychology.

It should be mentioned that Schulich also has linkages to some of the other signature areas identified by Western. For example, in the area of *Business Education and Research*, Schulich Medicine & Dentistry has collaborated with the Ivey School to develop a new stream within its MBA Program, the Richard Ivey School of Business Health Sector MBA, to combine the latest in business thinking with cutting-edge science.

Research Infrastructure

The availability of and access to state-of-the-art research infrastructure is essential for Schulich researchers to continue to achieve research excellence. Examples of recent major investments in biomedical research facilities have included:

- The London Regional Genomics Centre, providing state-of-the-art genome-wide or focused expression analyses and rapid DNA sequencing services for the local, regional and national clients, and funded through CFI and partnership among Western, Schulich and affiliated research institutes.
- The CFI/OIT-funded London Regional Innovarium, including the Transgenic and Gene Targeting Core Facility, providing state-of-the-art animal care facilities.
- The ORDCF-funded Western-led Protein Identification Facility.

- \$12 million from the Ontario Research Fund for new imaging equipment to be located at the Robarts Research Institute.
- CFI's investment into hybrid imaging and molecular imaging.
- Investments into the development of a "core informatics research facility" at Lawson Health Research Institute in support of collaborative research efforts.
- Research for the development of a Cyclotron and Radiochemistry Facility
- The Ontario Cancer Research Institute's investment into the development of new cancer diagnostic imaging.

A list of core research infrastructure available to Schulich researchers is provided in **Appendix C**.

Research infrastructure includes both core facilities and platform technologies:

- **Core Facilities** are facilities that provide a needed service for faculty from more than one department, institute, or research group, thereby enabling faculty to conduct their research or educational activities more efficiently and/or more effectively. These facilities are generally available on a fee-for-service basis to the entire London research community, enabling researchers and trainees to have local access to resources at reasonable cost, and facilitate the acquisition and maintenance of new instrumentation and technologies. Examples include the London Regional Genomics Centre and the London Regional Proteomics Centre.
- **Platform Technologies** enable research into and development of new technologies for research. Such research is essential to extend the capabilities of current technologies and develop the next generation of facilities. Examples include investment in imaging and microscopy.

Core Facilities and **Platform Technologies** are interrelated. An initial investment in a platform technology for research may lead to the development of a core facility. Conversely, the limitations of existing core facilities may lead to investment in research to develop new technologies.

Research infrastructure also includes such items as computing; networking and IT resources; research databases; resources necessary for health systems research, health services research, or population health research; biostatistical consulting services; and support for clinical trials design and management.

To ensure that researchers in Schulich Medicine & Dentistry are well equipped to continue their research, and in coordination with Western and with partners and other Faculties, Schulich Medicine & Dentistry will:

- Invest in and develop new facilities, with a priority given to the infrastructure necessary to foster opportunities in the current and emerging areas of excellence.
- Pursue funding for infrastructure development and renewal from external sources such as the Canada Foundation for Innovation and Ontario Research Fund.

- Provide resources for the operations and maintenance of research infrastructure and shared-use equipment. Schulich Medicine & Dentistry has initiated such support through an internal competition for support of operations and maintenance of core facilities, in part using funds made available through the Research Infrastructure Support Fund. However, a more coordinated and strategic approach to the operations and maintenance of facilities is necessary.
- Pursue the establishment of a city-wide committee for oversight of core research facilities. This city-wide committee would improve coordination and promote cost-efficiencies, and address issues including: strategic directions for core facilities, development of new core facilities, guidelines for financial management, standardization of policies for user fees, guidelines for access to facilities, harmonization of costs (e.g. for animal care facilities), and performance reporting. The committee would clearly define requirements/criteria for what constitutes a core facility and indicators of success for core facilities.
- Encourage coordination of facilities and equipment from the initial development stage through to implementation and operations. Current efforts at coordination often begin after a facility has been established, rather than during the planning phase. This can lead to duplication of facilities or to inefficiencies in support. Although some duplication of core facilities may be necessary to ensure city-wide access, these facilities would benefit from common oversight and centralized management.
- Establish a strategic building and renovation plan for the next decade that will allow its faculty to conduct cutting-edge and innovative research. Schulich Medicine & Dentistry continues to have significant issues related to space availability and utilization. This includes research space, including both wet-lab and dry-lab space, as well as office and classroom space. New space is required to organize the Schulich research on a thematic or programmatic basis. The School has begun to explore various options which will meet future needs and align us with Western's master plan and be prepared for potential funding opportunities from the provincial and federal governments, as well as for fundraising opportunities.

Graduate Students and Trainees

Recruiting and fostering outstanding graduate students and trainees is central to Schulich Medicine & Dentistry's continued research success. This contributes to the growth and vitality of the research enterprise within Schulich Medicine & Dentistry and helps ensure growth in the numbers of highly qualified personnel produced by Western.

Schulich Medicine & Dentistry has increased its focus on graduate students and trainees in the past few years. However, efforts to improve the training of graduate students and to expand opportunities for clinical trainees and fellows need to continue.

In addition, attention is needed to enhance the research experience of clinical and dental trainees and of postdoctoral fellows, a group that is essential to the research process but has received relatively less attention. For example, opportunities could be made available for postdoctoral fellows to gain teaching experience, or to take courses. Schulich Medicine & Dentistry will also strive towards further endowments to establish new funding programs for its faculty to recruit the best postdoctoral fellows.

Schulich Medicine & Dentistry has implemented a continuum of programs aimed at facilitating the development of new clinician-scientists (clinicians who spend at least 75% of their time on research) and clinician-researchers (clinicians who spend 40-75% of their time on research). For those in the early stages of their careers, these include the revitalized MD/PhD program, the Dental Clinician Scientist program and programs for medical and dental undergraduate students to gain research experience – the Summer Research Training Program (SRTP), Schulich Research Opportunities Program (SROP), and Dentistry's Summer Research Program. The Resident Research Career Development (RRDC) program provides training opportunities for promising residents aiming at an academic career and the new Schulich Clinician-Scientist Program supports promising young faculty members.

To improve the training of graduate students and trainees, Schulich will:

- Expand opportunities for graduate students to enhance their training. Such opportunities could include interdisciplinary training and specialized workshops, co-operative training and research programs with industry, international exchange programs and attending international meetings.
- Promote opportunities for ongoing interactions between basic medical science and clinical trainees. For example, basic trainees may be invited to present at grand rounds, and clinical trainees may be invited to present at department seminars.
- Improve the quality of supervision for graduate students and trainees through faculty development opportunities, mentoring workshops and other mechanisms.
- Provide a safety net to graduate students through Schulich Medicine & Dentistry's Gap competition for faculty.

- Improve administrative coordination related to graduate and postgraduate training. This may be through the creation of a graduate affairs Administrative Officer position, to coordinate and communicate opportunities for graduate students and postdoctoral fellows.
- Allocate further resources into its existing graduate programs as well as support the development of new interdisciplinary graduate programs, and enable the programs to recruit the best students.

City-wide and Regional Linkages

Schulich Medicine & Dentistry has adopted a city-wide approach to foster research activities, involving our partners – Western, London Health Sciences Centre (LHSC), St. Joseph's Health Care London (SJHC), and Lawson Health Research Institute (Lawson) – plus Robarts Research Institute (now a part of Schulich) and other Western Faculties. Further, as the Windsor Program develops, we plan to move beyond city-wide linkages to regional linkages and activities, and linkages with other sectors and industry. One such example of a regional approach is the development of the Lifecycle Research Network (LRN), a partnership involving Western, Lawson, the Universities of Waterloo, Windsor, and Guelph, LHSC, SJHC, Windsor Regional Cancer Centre and Robarts Research Institute.

Potential areas for expansion of cooperative efforts include better coordination in faculty hiring, evaluation and promotion. There may be advantages created by pooling resources between Schulich Medicine & Dentistry and partner institutions for hiring (e.g. salary funds, start-up funds, purchasing equipment, etc.). Other opportunities for city-wide linkages may include coordination of resources for the development of major grant applications; and investment in graduate students and trainees. Schulich Medicine & Dentistry will be guided in these investments by the priorities expressed in this plan.

It is important to create strategies that make hospital-employed research positions as attractive as tenure-track positions. Better ways are needed to foster linkages between researchers at different sites. Junior faculty, in particular, may not be aware of resources or potential collaborators located at another site, and may benefit from improved mentoring.

A city-wide approach does create some logistical challenges. Some attention is needed to the means of networking and interacting with researchers across various sites – particularly for students and trainees – through improved transportation/parking arrangements and improved access to videoconferencing and web conferencing facilities. The latter is likely the solution of the future and technology and affordability are rapidly improving. Improved communications will help to overcome these logistical issues.

To foster and improve city-wide and regional linkages Schulich Medicine & Dentistry will:

- Continue to strongly encourage a city-wide approach to research.
- Expand regional linkages and activities, and linkages with other sectors and industry.
- Expand cooperative efforts for coordination in faculty hiring, evaluation and promotion; coordination and resources for the development of major grant applications; and investment in graduate students and trainees.
- Improve opportunities for networking and developing interactions between various sites, particularly for students and trainees.

Internationalization and Interdisciplinary Activities

In 2003, Western adopted a Strategic Plan for Internationalization. Schulich Medicine & Dentistry has adopted internationalization as a priority, approaching it through means ranging from individual collaborations, to the establishment of joint research programs, to international development assistance and aid. In recent years, Schulich researchers have undertaken a number of projects with international focus. For example:

- Schulich researchers, together with partners across Ontario and in China, are focusing on traditional Chinese medicine.
- Schulich Medicine & Dentistry has instituted the Global Research Opportunities in Health (GROH) program to enable medical students to undertake research in lesser-developed countries.
- A Schulich researcher is working on bacterial research program in Kenya that will help in the prevention of gastrointestinal, urinary tract infections, and HIV transmission through the use of probiotics.
- A collaborative research project involving Schulich researchers and researchers from Finland focuses on reducing the cardiovascular complications of diabetes.
- Schulich Medicine & Dentistry is partnering with Egerton University (Kenya) on an ecosystem health study of Lake Naivasha, Kenya.

The productivity and innovative research of Schulich faculty is significantly enhanced when they work collaboratively in an interdisciplinary manner. Schulich has fostered and engaged in a number of interdisciplinary efforts. Among the many examples of such activities are:

- The Graduate Program in Developmental Biology, a joint initiative of Schulich Medicine & Dentistry and the Faculty of Science, includes scientists working with embryos during their earliest stages of development as well as a strong group of researchers looking at the development of the late term fetus.

- The Centre for Education in Diagnostic Radiology and Nuclear Medicine, a collaborative effort between the Department of Medical Imaging and the Faculty of Education, to advance educational scholarship and research in medical imaging education.
- The Collaborative program in Biostatistics, an initiative of the Departments of Epidemiology and Biostatistics (Schulich) and Statistical and Actuarial Sciences (Science) which supports graduate students whose research is directed at developing methods for health and health-services research.
- A multi-Faculty, interdisciplinary research program on Biomineralization launched by Schulich researchers.
- The Collaborative Graduate Program in Molecular Imaging, a new collaborative effort of the Faculty of Science and Schulich Medicine & Dentistry, will support a community of graduate students with interests in molecular and cell biology, chemical probe development and diagnostic imaging.
- Four CIHR-funded Strategic Training Programs based in London – cancer research, vascular research, primary health care, and oral research – have engaged graduate students and trainees in interdisciplinary training and research.

To foster internationalization and interdisciplinary activities within the School, Schulich Medicine & Dentistry will:

- Encourage individual researchers and research groups to take advantage of opportunities to engage in international and interdisciplinary activities.

Opportunities for Knowledge Transfer

Over the past decade, there has been increasing interest in applying the benefits of research to the service of the community and society. Such activity can be termed Knowledge Transfer (KT), defined by CIHR as “a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically sound application of knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system.”

Research on KT is not currently an area of activity at Schulich. To improve this, the School will strengthen and foster research linkages with other Western Faculties and institutions to strengthen its capabilities in this area. The development of a core facility for KT at Western would be of benefit to the School.

To enhance opportunities for Knowledge Transfer, Schulich Medicine & Dentistry will:

- Increase partnerships and collaborations with other institutions and Faculties to develop innovative education and outreach programs.

- Increase KT activities through Continuing Medical Education and Continuing Dental Education programs, the establishment of start-up companies, and through Western's Office of Industry Liaison.
- Encourage researchers to take advantage of programs such as the Western Innovation Fund, which provides direct assistance in product and technology development.
- Coordinate the management of technology transfer with Western, Robarts, and the Lawson Health Research Institute. The formation of WORLDiscoveries, a new, city-wide technology transfer consortium, will be of benefit to Schulich researchers.
- Strengthen and foster research linkages with other Faculties and institutions to strengthen its capabilities in KT.

Looking to the Future

Investigator-driven and knowledge-focused research is, and will continue to be, the foundation of research excellence at Schulich Medicine & Dentistry. The School has identified seven areas of research excellence based on sustained research productivity, leadership and innovation of researchers and research groups within each area. These research areas have enhanced Schulich Medicine & Dentistry's reputation for research nationally and internationally. Two of these areas have been identified as "signature areas" by The University of Western Ontario. The School has also identified seven emerging areas of research strength based on the recruitment of new leaders, the development of innovative research and the establishment of new platform technologies and/or core facilities.

Schulich Medicine & Dentistry will need to make optimal use of federal and provincial programs such as the Canada Foundation for Innovation, Canada Research Chairs, Ontario Research Fund, and the Province of Ontario's Early Researcher Awards programs to attract and retain the very best researchers in areas of research excellence and in emerging areas of research. Schulich Medicine & Dentistry plans to develop new guidelines for the allocation of its Canada Research Chairs and endowed chair positions that will allow the recruitment and retention of the best researchers to its departments and affiliated research institutes.

The federal and provincial governments are increasingly focused on translational research and are putting resources towards directed research. Schulich will utilize its collaborative faculty within the School and its affiliated research institutes to develop interdisciplinary teams or groups which will be competitive in the acquisition of funds from provincial, national and international funding sources.

Schulich Medicine & Dentistry's future lies in its clinical and research trainees. The School will enhance its MD/PhD Program and strive to become one of the top and most desirable MD/PhD programs in Canada. The School will further develop its programs for

medical and dental students to acquire research skills during their undergraduate and postgraduate training, and utilize its Clinician Scientist Program to recruit the best-trained clinical faculty and increase its cadre of clinician scientists. The School will allocate further resources into its existing graduate programs as well as support the development of new interdisciplinary graduate programs, to enable recruitment of the best graduate students. It will also strive towards further endowments to establish new funding for faculty to recruit the best graduate students and postdoctoral fellows.

Schulich Medicine & Dentistry has made major investments in developing and sustaining state-of-the-art platform technologies and core facilities to enable faculty to have access to and utilize cutting-edge research tools in their research. The governance of these facilities has occurred in partnership with the University and its affiliated research institutes. Schulich will strongly support efforts to acquire new infrastructure through competitive national and provincial funding programs, and will invest resources to keep facilities current and appropriately resourced.

The productivity and innovative research of Schulich faculty is significantly enhanced when they work collaboratively in an interdisciplinary manner. New space is required to organize the School's research in thematic or programmatic basis. Schulich will establish a strategic building and renovation plan for the next decade that will allow its faculty to conduct cutting-edge and innovative research. It will embark on a fundraising campaign to realize this goal, focused on innovative research and teaching.

Over the next five years, Schulich Medicine & Dentistry will:

- Develop interdisciplinary teams or groups that are competitive in the acquisition of funds from provincial, national and international funding sources, and are effective and efficient in achieving the research goals.
- Strive for more of its areas of research excellence to be recognized as “signature areas” of Western.
- Make optimal use of federal and provincial programs to attract and retain the very best researchers in areas of research excellence and in emerging areas of research.
- Develop new guidelines for the allocation of its Canada Research Chairs and endowed chair positions to allow the recruitment and retention of the best researchers to its departments and affiliated research institutes.
- Enhance programs and support for its clinical and research trainees.
- Strongly support efforts to acquire new infrastructure through competitive funding from national and provincial funding sources, and invest resources in maintaining and sustaining facilities, together with their necessary equipment and personnel.

- Establish a strategic building and space plan for the next decade that will enable its faculty to conduct cutting edge and innovative research.
- Endeavor to demonstrate how research at Schulich is improving the health of Canadians and the provision of health care.

Through the actions outlined in this Plan, Schulich Medicine & Dentistry will:

- Increase the number of faculty with external peer-reviewed research funding and aim to become one of the top medical and dental schools in the country with most grant funds per capita faculty.
- Increase the ratio of PhD students to Masters students within the overall graduate student population of the School.
- Increase the numbers of graduate students and postdoctoral fellows with external scholarships.
- Increase the number of medicine and dentistry undergraduate students involved in research and aim to become the top medical and dental schools in the country with highest participation and productive medical and dental students in research.
- Increase the number of clinician scientists and clinician researchers obtaining external salary and research support, and aim to become one of the top medical and dental schools in the country with the highest ratio of clinician scientists among clinical faculty.
- Ensure that its core facilities become financially stable.
- Increase interactions and collaborations with partner universities in Southwestern Ontario to achieve research findings that will improve health of the people of the region, and of all Canadians.

With a strong and motivated faculty, trainees and staff who believe research is an essential fabric of their academic mission; with well established state-of-the-art research infrastructure and core facilities that are developed and sustained collaboratively among its partners; and with a cohesive Health Research Plan, the Schulich School of Medicine & Dentistry can become one of the top biomedical research institutions in Canada and the world.

Appendix A : Highlights of Areas of Research Excellence and Emerging Areas of Research Excellence

These highlights serve as illustrative examples of the types of activities in each of the seven Areas of Research Excellence. They are not meant to limit or exclude other related activities.

Areas of Research Excellence

Biomedical Imaging

Biomedical Imaging research at Schulich Medicine & Dentistry is highly integrated and collaborative, including researchers in the Imaging Research Laboratories at the Robarts Research Institute and the Imaging Program of the Lawson Health Research Institute. The focus is on the discovery and development of innovative imaging techniques and instrumentation to improve the understanding, diagnosis and treatment of human diseases. Areas of research include: Imaging in Neurosciences & Mental Health, Cardiovascular and Neurovascular Imaging, Animal, Micro- and Molecular Imaging and Image-Guided Surgery and Therapy. Activities include the development and translation of imaging technologies such as MRI, CT, ultrasound, PET, SPECT and X-ray imaging. Applications range from use in basic discovery with research animal models to use in clinical trials with human research subjects. Recent highlights include a \$27-million grant from CFI/ORF for Biomedical Multimodality Hybrid Imaging to fund new infrastructure; and a \$500,000-grant from the Ontario Institute for Cancer Research for three-dimensional ultrasound guided prostate imaging.

Cancer

The Department of Oncology, based at the London Regional Cancer Program, supports both clinical and basic science research in Oncology. Researchers in other Schulich departments are also actively engaged in Cancer research. Priorities include the discovery of biological information for targeted therapy and non-invasive cancer detection, development of non-invasive tumor imaging to detect cancer early and inform personalized cancer treatment, detection and targeting of cancer stem cells, training the next generation of cancer researchers, and connecting basic/translational cancer researchers with clinical and imaging researchers to achieve these goals. Cancer research includes multiple integrated cancer-care and research programs that feature organized teams of basic, translational, and clinical researchers focused on the translation of knowledge between basic science and clinical settings. Of note are:

- The CIHR Strategic Training Program in Cancer Research and Technology Transfer, which trains basic and clinical researchers to interact with each other, the private sector and the public to translate discoveries into action to prevent, diagnose and treat cancer
- The CIHR Team in Image Guidance for Prostate Cancer to evaluate new techniques that can identify and characterize cancers in individual men to better select treatments and enable minimally invasive therapies to improve outcomes and reduce side-effects.

Cardiovascular, Respiratory Health, and Metabolic Diseases

Cardiovascular and Respiratory Health includes basic and clinical research on a range of topics areas as atherosclerosis, cardiac valve biology, vascular biology, vascular imaging, sepsis, inflammatory lung diseases and diabetes. Western's presence in cardiovascular research has a historical basis, and this is expanding as sophisticated technology is applied to the genetics, physiology, diagnosis and treatment of cardiovascular health and disease. Clinical research in diabetes is a major strength, involving both single and multi-centre clinical trials for Type I and Type II diabetes.

Infection and Immunity

This area includes research in the molecular and cellular biology of microorganisms and the molecular and cellular biology of the immune system. A centre of activity is the FOCIS Centre for Clinical Immunology and Immunotherapeutics, a network of multidisciplinary researchers in London that aims to foster novel collaborations and speed discoveries from the lab to the clinic. The Infectious Diseases Research Group, based in the Department of Microbiology and Immunology, aims to gain a better understanding of complex interactions between microbial and human cells at the molecular and cellular levels. The Group integrates highly sophisticated visualization techniques with microbial genomics and proteomics, and models of infectious diseases, with the goal to create ground-breaking approaches for the functional analysis of pathogenic bacteria as they interact with host cells within organs and tissues. Also of note, the CIHR Institute of Infection and Immunity, based at The University of Western Ontario, supports research and helps to build research capacity in the areas of infectious disease and the body's immune system.

Maternal, Fetal, Child and Family Health

Maternal, Fetal, Child and Family Health encompasses research into reproductive, maternal and fetal health, developmental biology, newborn, child, youth and family health occurring at the Children's Health Research Institute (CHRI). CHRI includes five major research programs – Developmental Biology, Fetal and Newborn Health, Molecular Genetics, Children's Optimal Therapeutics and Child Health and Well-Being – to form a continuum of research from preimplantation to adolescent health. CHRI's biomedical/clinical research programs have coordinated and collaborated with the Schulich basic medical science departments to establish a new Graduate Program in Developmental Biology, which includes scientists working with embryos during their earliest stages of development as well as a strong group of researchers looking at the development of the late-term fetus. Major contributions are also made by the Centre for Studies in Family Medicine, which focuses on the enhancement of family medicine and primary health care practice, and the CIHR-funded Transdisciplinary Understanding and Training on Research Primary Health Care (TUTOR-PHC), a national program for interdisciplinary research training in primary health care to meet the immediate need for research capacity in this field.

Musculoskeletal Health

Musculoskeletal Health includes researchers in skeletal biology, orthopaedics, rheumatology, dentistry, clinical trials, imaging, rehabilitation and geriatrics. A major focus is the multidisciplinary CIHR Group in Skeletal Development and Remodeling. Members of the CIHR Group interact with colleagues to facilitate the full range of musculoskeletal research at Schulich Medicine & Dentistry, from cellular and molecular mechanisms underlying the formation and destruction of bone and cartilage through to the construction and clinical testing of biomechanical implants. Members of the CIHR Group are participants in the Canadian Arthritis Network, a Network of Centres of Excellence funded by the federal government. Other areas of musculoskeletal research at Schulich Medicine & Dentistry include:

- Participation in the New Emerging Team in Osteoarthritis, targeted at prevention, detection and management of osteoarthritis.
- Research on neuromuscular function in health, aging, and disease, to strengthen collaborations between researchers in the musculoskeletal and neurosciences areas.
- Tissue engineering and regeneration.
- Interactions with researchers in the Faculty of Health Sciences.

Neuroscience and Mental Health

Neuroscience and Mental Health is a broad area that brings together clinicians and basic scientists in research on complex neurological and neuropsychiatric disorders. The emphasis is on understanding the psychobiology and neurological mechanisms of these disorders and the development and evaluation of therapies and surgical interventions that may alleviate the symptoms or slow the progression of neurological and neuropsychiatric diseases and disorders. Neuroscience is an interdisciplinary field covering a vast range of topics including research on how nerve cells are born, develop and communicate with each other, how perceptual systems like vision and hearing tell us about the world around us, and how disorders of the nervous system lead to brain diseases such as stroke, Alzheimer's, ALS, schizophrenia, depression, and substance abuse. Western's multi-Faculty, multi-disciplinary Graduate Program in Neuroscience provides a focus for research, including researchers in cognitive science, neuroimaging, neuropsychology, behavioral neuroscience, neurophysiology, neural development, neuropharmacology, neuroanatomy, and cellular and molecular biology. Another centre for research is the Consortium for Applied Research and Evaluation in Mental Health (CAREMH), which focuses on improving the well-being of persons with serious mental illness by promoting applied research, evaluation and knowledge transfer in mental health services. CAREMH is complemented by clinical research in the Program for Early Intervention in Psychosis, and the First Episode Mood and Anxiety Disorder Program.

Emerging Areas of Research Excellence

Aging and Geriatric Medicine

Primary areas of basic and applied clinical research include stroke and cardiac rehabilitation, spinal cord injury, musculoskeletal rehabilitation, chronic pain, geriatric medicine, health services, Alzheimer's disease, quality of life and quality of care, and wound healing. There are linkages to the Canadian Centre for Activity & Aging, Geriatric Clinical Trials Group and the Stroke Rehabilitation Research Program at Parkwood Hospital.

Clinical Pharmacology and Personalized Medicine

The new Centre for Clinical Investigation & Therapeutics (CCIT) at the London Health Sciences Centre is one of the first centres of its kind in Canada for bench-to-bedside research and clinical trials. CCIT is dedicated to advancing knowledge of determinants of variation in drug disposition, adverse drug reactions, and to uncover novel mechanisms of drug action.

Environment and Health

A focus on Environmental Pathology and Ecosystem Health includes transdisciplinary research on the interrelationships between humans and all aspects of their environment, including disease, health and well-being. In this context, the health of all parts and individual species of the ecosystem is important, particularly where illness is due to exposures to pollutant chemicals or biological agents in the environment. In addition, the Ecosystem Health Program has endeavored to increase ecosystem health knowledge and awareness within Schulich Medicine & Dentistry and the larger University community.

Genomics, Proteomics and Bioinformatics

Researchers in these areas benefit from the development of the London Regional Genomics Centre and the London Regional Proteomics Centre. Western's Bioinformatics initiative combines the skills and facilities present in Schulich, Robarts and the Faculties of Science and Engineering to implement an interdisciplinary and multi-institutional approach that will develop novel perspectives in computer science, medicine, biology and engineering.

Health Services, Delivery and Policy

A number of groups within Schulich Medicine & Dentistry focus on activities in these areas, including: the Centre for Studies in Family Medicine, which focuses on the enhancement of family medicine and primary health care practice; the Consortium for Applied Research and Evaluation in Mental Health, which focuses on improving the well-being of persons with serious mental illness by promoting applied research, evaluation and knowledge transfer in mental health services; and the Health Outcomes and Health Services research theme at Lawson. Methods for health services research are being advanced by investigators in Robarts Clinical Trials and in the Department of Epidemiology and Biostatistics. A Health Policy Initiative connects researchers from seven faculties across campus.

Innovative Surgical Therapies

Research foci include robotics, minimally-invasive surgery, and image-guided surgery. A centre for activities is the Canadian Surgical Technologies and Advanced Robotics (CSTAR), which integrates research, development, pre-clinical and clinical testing, validation, commercialization and clinical implementation.

Population Health

Research is conducted in areas such as the determinants of health, causal modelling of disease etiology, methods for the design and conduct of epidemiological studies, biostatistical research on methods for analysis of population level data, and methods for detection of interactions. The Department of Epidemiology and Biostatistics has a large and growing graduate student population in this area and has extensive collaboration with clinical departments as well as collaborations with population scientists in Sociology and Geography. The Population and Community Health Unit (PCHU), associated with the Department of Family Medicine, engages in epidemiological, analytical, and evaluative research, and health-related data collection, with a special interest in the communities of London and Southwestern Ontario.

Appendix B: Criteria for Research Excellence

Areas of Research Excellence are expected to demonstrate performance in most, if not all, of the categories below. Emerging Areas of Research excellence should have the potential for significant scientific advancement, and show measurable performance in the categories of scientific excellence, transdisciplinary research and collaborations, and research. The following criteria were considered in the evaluation of research areas.

- **Breakthrough accomplishments:** self-identified, “firsts”, publications in top journals.
- **Scientific excellence:** objective recognition by independent organizations, grant funding, publications, citations, external prizes and salary awards to faculty, membership on national/international committees and boards, invited lectureships.
- **Outstanding training program:** numbers of trainees (undergrad, graduate, postdoctoral fellows, residents), quality of trainees as indicated by external scholarships and awards to individual trainees, quality of training programs (external training grants to programs), placement and success of trainees in subsequent careers.
- **Cohesive team with excellent leadership:** recognized team efforts, outstanding leaders with experience, well-managed core facilities, effective mentorship of junior faculty.
- **Demonstrated transdisciplinary research and collaborations:** collaborations among disciplines, sectors and institutions (regional, national and international), team grants, co-authorship on manuscripts, co-applicants on grants, co-supervision of trainees, participation in provincial, national and international networks.
- **Improved patient care, enhanced health of Canadians, reduced health care costs:** evidence of knowledge translation-exchange, improved quality of life, impact on health care delivery-policy.
- **Technology development and commercialization:** disclosures, patents, licenses, industrial contracts and collaborations, spin-off companies.
- **Community relations and outreach:** public lectures, direct community interaction, media coverage, public consultation.
- **Ongoing development and renewal:** takes advantage of emerging scientific discoveries or technological advances, new recruitments in emerging areas, new collaborations, innovations in research training.

Appendix C: Research Infrastructure in Schulich Medicine & Dentistry

Regional Centres

London Regional Cell and In Vitro Molecular Imaging Facility

This facility centralizes management of confocal infrastructure available to researchers within the Schulich School of Medicine & Dentistry and Robarts Research Institute. Contacts: Dr. Kem Rogers, Kem.Rogers@schulich.uwo.ca or Dr. Stephen Ferguson, ferguson@robarts.ca

London Regional Cell and In Vivo Molecular Imaging Facility

The facility includes infrastructure for whole body MRI, brain MRI/S, spectroscopy, neonatal imaging, bioelectromagnetics, optical imaging and quantitative cardiac imaging. www.lawsonimaging.ca/labs.htm

Centre for Functional and Metabolic Mapping

Currently pursuing research interests in many aspects of Magnetic Resonance Imaging (MRI) and Magnetic Resonance Spectroscopy (MRS). www.cfmm.robarts.ca

London Regional Genomics Centre

The facility provides services on a fee-for-service/cost recovery basis and offers both Affymetrix GeneChip technologies and spotted cDNA microarray services. www.lrgc.ca

Transgenic and Gene Targeting Facility

The facility generates transgenic mice for biomedical research in London and provides gene targeting services. Services include consultation, design of transgenes and targeting constructs, and support in genotyping and analysis of genetically manipulated mouse lines. www.lhsc.on.ca/Research_Training/LRCP/Research_Groups/TransgenicTargetingFacility.htm

London Regional Proteomics Centre

The London Regional Proteomics Centre oversees a group of facilities housing an integrated set of platform technologies with a goal to enhance the development of proteomics and functional genomics research in London. www.lrpc.uwo.ca/

The Centre includes the following components facilities:

- **Biological Mass Spectrometry Laboratory**

The BMSL is a part of the Ontario Wide Protein Identification Facility (OWPIF). Some of the works performed at BSML include: mass determination of polar and/or high molecular weight molecules including peptides, proteins, glycoproteins, etc.;

sequence determination of peptides and peptides from proteins digests; and types and sites of protein modifications.

www.biochem.uwo.ca/wits/bmsl/bmslhome.html

- **Biomolecular Interactions and Conformations Facility**

The Biomolecular Interactions and Conformations Facility is an instrumentation centre within the Department of Biochemistry. The facility provides access to state-of-the-art equipment and high quality services to researchers both on campus and beyond, tailoring experiments to meet each client's own research objectives.

www.biochem.uwo.ca/bicf/BICF-home.html

- **Biomolecular NMR Facility**

The Biomolecular NMR Facility is a multi-user facility for researchers interested in using nuclear magnetic resonance (NMR) to address key biological questions.

www.biochem.uwo.ca/wits/bionmrl/index.html

- **Functional Genomics and Proteomics Facility**

The Functional Genomics and Proteomics Facility is equipped with instrumentation for the fractionation of complex biological mixtures using chromatographic and electrophoretic procedures as well as instrumentation for the subsequent analysis and processing of these samples in preparation for analysis by mass spectrometry.

www.biochem.uwo.ca/wits/fpf/

- **Macromolecular Crystallography Facility**

The Macromolecular Crystallography Facility (MCF) is used to solve structures of biological macromolecules by X-ray crystallography.

www.biochem.uwo.ca/wits/MCF/mcf-home.html

- **MALDI-TOF Mass Spectrometry Facility**

Three matrix-assisted laser desorption/ionization (MALDI) mass spectrometers (MS) are available to provide high-throughput, fast, mass analysis of pre-purified proteins and peptides. Contact: Dr. Ken Yeung, kyeung@uwo.ca

Other Core Facilities

2D and 3D Micro-ultrasound Imaging Facility

Two ultrasound systems designed for imaging mice at 50 to 100 mm spatial resolution are available in the Imaging Research Laboratories at Robarts Research Institute.

Contact: Dr. James Lacefield, jlace@imaging.robarts.ca

2D and 3D Ultrasound Imaging Facility

The facility contains four ultrasound machines with a variety of ultrasound transducers. In addition, the facility includes four three-dimensional (3D) imaging systems capable of acquiring 3D ultrasound images in a few seconds.

Contact: Dr. Aaron Fenster, afenster@imaging.robarts.ca

Bioelectromagnetics Research Laboratories

Present facilities include three extremely low frequency (<2000 Hz) magnetic field exposure systems, two (1m and 2m cubed) orthogonal three dimensional nested coil electromagnetic field exposure systems and a single coil pair system to accommodate standing or sitting human subjects, and magnetic shielded facility.

www.lawsonimaging.ca/investigators/athomas/athomas.htm

Biostatistical Support Unit

The Biostatistical Support Unit (BSU) is a statistical consulting service focused on design and analysis of health research studies and clinical trials.

www.uwo.ca/epidem/Consulting/BSU/BSU.html

Brain Tumour Tissue Bank

The facility supplies brain tumour tissues to researchers across Canada and all over the world.

www.braintumour.ca/braintumour.nsf/eng/TissueBankResearchers

Cryo-sectioning Laboratory

This core facility provides infrastructure and training for cryo-sectioning.

Contact: Dr. Subrata Chakrabarti, subrata.chakrabarti@schulich.uwo.ca

Experimental Transplant Pathology Laboratory

The laboratory provides standardized routine histology, electron microscopy, immunohistochemistry for various species such as monkey, baboon, pig, dog and rodents at the light microscopic or at the ultra structural level, in situ hybridization, apoptosis and morphometric analysis.

<http://publish.uwo.ca/~bgarcia/>

Gene Expression Core Facility (Skeletal Biology Laboratories)

Two instruments are available for analyses of gene expression: an Applied Biosystems Real Time PCR instrument, model 7900HT Sequence Detection System; and a Tecan Safire microplate monochromator reader.

www.cihrskeletal.ca/core-facilities.htm

Imaging Research Laboratories (Robarts Research Institute)

The Imaging Research Laboratories house approximately \$20 million in imaging and engineering equipment required to perform leading-edge medical imaging research.

www.imaging.robarts.ca/

Lawson Cyclotron and Radiochemistry Facility

The cyclotron facility will support a wide variety of research projects including PET imaging applied to oncology, cardiology, neurology, psychology, bioelectromagnetics, and other research areas.

Contact: Dr. Michael Kovacs, mkovacs@lawsonimaging.ca

Lawson Health Research Institute Clinical Research Services

A versatile, fully-staffed clinical trials facility established by the Lawson Health Research Institute provides increased clinical trials capacity to investigators from London Health Sciences Centre, St. Joseph's Health Care London and community physicians and dentists.

www.lawsonresearch.com/v1.0/website/research_services.htm

LHSC Sleep Laboratory and Sleep Clinic

The LHSC Sleep Laboratory and Sleep Clinic focus on the diagnosis, treatment and clinical research on adults with sleep disorders.

Contact: Dr. Charles George, cgeorge@uwo.ca

London Regional Flow Cytometry Facility

Cytometry refers to the measurement of physical and/or chemical characteristics of cells or other biological particles. Flow Cytometry is a process in which such measurements are made while the cells or particles pass, preferably in single file, through the measuring apparatus in a fluid stream. Flow Sorting (FACS) extends flow cytometry by using electrical or mechanical means to divert and collect cells with one or more measured characteristics falling within a range or ranges of values set by the user.

www.robarts.ca/gateway.php?id=27

Microscopic Image Analysis Facility

This facility provides infrastructure and training for light and fluorescence microscopy and image analysis.

Contact: Dr. Subrata Chakrabarti, subrata.chakrabarti@schulich.uwo.ca

Multi-slice CT Scanner

Perfusion and transcapillary permeability imaging in animal models and human studies.

Contact: Dr. Ting-Yim Lee, tlee@imaging.robarts.ca

Near Infra-red Spectroscopy

Facility for cerebral blood flow measurement in small animals and neonates.

Contact: Dr. Ting-Yim Lee, tlee@imaging.robarts.ca

Peptide Synthesis Facility

Preparation of highly purified synthetic peptides of ~3-35 amino acids in length. Scale: 10 mg to 500 mg. Synthetic peptides for structural studies and antibodies production.

Contact: Dr. Gilles Lajoie, glajoie@uwo.ca

Real Time PCR Facility

The facility provides access to rapid real time PCR equipment [lightcycler™].

Contact: Dr. Subrata Chakrabarti, subrata.chakrabarti@schulich.uwo.ca

Robarts Clinical Trials

Robarts Clinical Trials is a centre of academic excellence for clinical research and a contract research organization with proven expertise in conducting multi-centre clinical trials.

www.robarts.ca/clinicaltrials

Robarts HeliSpin™ Facility

The HeliSpin™ facility processes helium-3 used for magnetic resonance (MR) imaging of the lungs, which is not possible with conventional (proton) MR imaging.

Contact: Dr. Giles Santyr, gsantyr@imaging.robarts.ca

Screening Lab for Immune Disorders

The lab offers bead-based multiplexed immunoassays, used in biomarker discovery, and bench-to-bedside translational research to improve health management.

Contact: Dr. Kelly Summers, ksummers@uwo.ca

Skeletal Biology Laboratories Core Facilities

The CIHR Group in Skeletal Development and Remodeling operates a suite of core facilities, including a Microscopy and Imaging Core Facility; Wide-field Optical and Fluorescence Imaging Systems; and a Gene Expression Core Facility.

www.cihrskeletal.ca/core-facilities.htm

Transmission Electron Microscopy Facility

The facility provides materials for negative staining and thin sectioning techniques of prokaryotic and eukaryotic cells, as well as immunoelectron microscopy.

Contact: Dr. S.F. Koval, skoval@uwo.ca

Victoria Research Laboratory Confocal Microscope Core Facility

The VRL Confocal Microscope Core Facility provides technology, training and supervision for researchers to conduct high resolution imaging on the spatial and temporal characteristics of a wide range of (fluorescent-tagged) molecules expressed in cells and tissues.

Virtual Augmentation and Simulation for Surgery and Therapy (VASST lab)

The VASST lab comprises a high performance computing facility optimized for simulation and visualization of procedures involved in image-guided surgery and therapy.

www.imaging.robarts.ca/vasst/

Appendix D: Research Groups and Centres in the Schulich School of Medicine & Dentistry and Partner Institutions

Biomaterials Program

The biomaterials program focuses on the design, creation and modification of new and existing biocompatible materials for medical devices. Devices being investigated include heart valves, vascular prostheses and artificial skin/occlusive wound dressing. Properties of soft tissues as related to the cardiovascular system are also studied.

www.engga.uwo.ca/research/biomed/Research/Biomaterials.htm

BioTherapeutics Research Group

The group aims to understand the basic mechanisms behind immune-mediated pathologies across five basic themes: neurotrauma, organ transplantation, infectious disease, adverse drug reactions and vascular biology. Its goal is to develop and test new biotherapeutic approaches to disease.

www.robarts.ca/biotherapeutics/

Canadian Research and Development Centre for Probiotics

The Canadian Research & Development Centre for Probiotics was created to strengthen the foundation for probiotic research and development in Canada.

www.crdc-probiotics.ca/

Canadian Surgical Technologies & Advanced Robotics (CSTAR)

CSTAR integrates research, development, preclinical and clinical testing, validation, commercialization and clinical implementation of Minimally Invasive Surgery (MIS) technologies and robotics.

www.lhsc.on.ca/About_Us/CSTAR/

Cancer Research Laboratory Program (CRLP)

CRLP brings together scientists and clinicians from many different specialties to investigate cancer problems in a cross disciplinary fashion. Researchers study the many biological processes that contribute to controlling gene expression, and the events that cause appropriate control of genes in healthy human cells to go awry and allow cancer to develop.

www.lhsc.on.ca/Research_Training/LRCP/Research_Groups/index.htm

The CRLP includes:

- **Translational Breast Cancer Research Unit**, which promotes interactions between scientists and physicians throughout London and facilitates "translation" of molecular, cellular or genetic research findings to improvements in diagnosis, treatment, or prevention of breast cancer.
www.lhsc.on.ca/Research_Training/LRCP/Research_Groups/TranslationalBreastCancerResearch.htm

- **Translational Head/Neck Cancer Research Group**

This group is engaged in clinical outcomes research, translational cancer research, and investigation of technological innovations.

www.lhsc.on.ca/Research_Training/LRCP/Research_Groups/TranslationalHeadNeckCancerResearchGroup.htm

- **Translational Prostate Cancer Research Group**

This group's purpose is to foster an environment where fundamental cancer researchers, surgeons, and clinical researchers work together to quickly transfer research discoveries from the "bench to the bedside" and make real advances in prostate cancer control.

www.lhsc.on.ca/Research_Training/LRCP/Research_Groups/TranslationalProstateCancerResearchGroup.htm

Centre for Pain Research

The mission of the Centre for Pain Research is to advance knowledge of the mechanisms responsible for acute and chronic pain and to improve treatment of debilitating pain states. The centre accomplishes these goals through multi-disciplinary and multi-institutional academic collaborations.

www.londonpain.ca

Centre for Studies in Family Medicine

The CSFM focuses on the enhancement of family medicine and primary health care practice which will reflect a partnership of the community and interdisciplinary teams committed to proactive patient-centred care.

www.uwo.ca/fammed/csfm/

Centre for Critical Illness Research

The centre studies the mechanisms involved in the pathogenesis of diseases/syndromes encountered in Intensive Care Units with the ultimate goal of translating the discoveries to improved health care for patients.

www.lhsc.on.ca/vascularbio/

CIHR Group for Action and Perception

The long-term research goals of this group are:

- to explore how visual information is transformed into perceptual representations and motor acts, and how different perceptual representations interact with different motor pathways.
- to identify the neural circuitry for these different transformations, particularly in cerebral cortex, by means of functional magnetic resonance imaging (fMRI), studies of neurological patients with damage to particular visual areas, and behavioural and electrophysiological studies.
- to develop computational models for visual object recognition and for the visual control of a range of motor acts from saccades to manual prehension.

www.schulich.uwo.ca/physpharm/groups/gap//index.htm

CIHR Group in Fetal Growth Restriction

The group focuses on research to identify mechanisms that cause disease processes in placenta and fetus that underlie fetal growth restriction (FGR). It also studies how conditions that cause FGR lead to adaptive processes in the cardiovascular, endocrine and nervous systems of the fetus that lead to developmental programming. These studies will lead to innovative diagnostics and improved methods of managing FGR pregnancies, and new intervention strategies that will enhance short and long term health of these infants.

CIHR Group in Skeletal Development and Remodeling

The CIHR Group in Skeletal Development and Remodeling carries out basic research on the cellular and molecular mechanisms underlying the formation and destruction of bone and cartilage, and the diagnosis and treatment of skeletal and dental diseases. Experimental approaches include protein chemistry, molecular biology, physical chemistry, cell biology, patch clamp and calcium fluorescence. The aim is better understanding of the pathogenesis and treatment of diseases such as osteoporosis, arthritis and periodontitis, and pathological calcifications such as kidney stones.

www.med.uwo.ca/research/skeletal-web/

CIHR Team in Image Guidance for Prostate Cancer

This team will evaluate new techniques that can identify and characterize cancers in individual men to better select treatments and enable minimally invasive therapies to improve outcomes and reduce side effects.

Centre for Vascular Imaging Research

The centre's mission is to research and promote the development and commercial exploitation of, advanced vascular imaging technology.

www.imaging.robarts.ca/cvir/

Consortium for Applied Research and Evaluation in Mental Health

The consortium focuses on improving the well-being of persons with serious mental illness (SMI) by promoting applied research, evaluation and knowledge transfer in mental health services.

<http://caremh.ca/>

Critical Care Research Network

The Critical Care Research Network's mission is to improve patient care and resource utilization through the rigorous evaluation of health delivery systems.

www.criticalcareresearch.net/

EpiGenWestern

EpiGenWestern aims to better understand epigenetics as it relates to the basic biology of human development, the process of tumorigenesis and how cells respond to changes in the environment; and to translate research into improved molecular diagnostics, advancements in assisted reproductive technologies and in the development of novel targeted therapies for genetic diseases including cancer.

<http://publish.uwo.ca/~drodenhi/EpiGenWestern.html>

First Episode Mood and Anxiety Disorders Program

This program focuses on research into the neurobiology of mood and anxiety disorders, with an emphasis on youth having difficulties associated with mood or anxiety symptoms.

Hand and Upper Limb Clinic

The hand surgery research program at HULC is well-known nationally and internationally. HULC includes a bioengineering lab, a cell and molecular biology lab and a clinical research lab. Clinical outcomes research has led to the development of patient-rated evaluation tools that are now used all over the world.

www.uwo.ca/surgery/plastics/HULC/

Image-Guided Surgery and Therapy

The goal of this research program is to develop minimally invasive surgery and therapy techniques based on image guidance using advanced computational, robotic and imaging techniques. The imaging techniques being used are 3D MR, 3D CT and 3D ultrasound, with medical applications in: image-guided neuro-surgery, image-guided minimally invasive prostate therapy, image-guided breast biopsy, image guided orthopedic surgery, and image guided robotic cardiac surgery.

www.engga.uwo.ca/research/biomed/Research/IGST.htm

Imaging Research Laboratories

The Imaging Research Laboratories at Robarts focus on the discovery and development of innovative imaging techniques and instrumentation to improve the understanding, diagnosis and treatment of human diseases including cancer, cardiovascular and orthopedic disease, schizophrenia and other brain disorders.

www.imaging.robarts.ca/

Infectious Diseases Research Group

The Infectious Diseases Research Group integrates highly sophisticated visualization techniques with microbial genomics and proteomics, and models of infectious diseases. The goal is to create ground-breaking approaches for the functional analysis of pathogenic bacteria as they interact with host cells within organs and tissues.

Molecular Brain Research Group

The group aims to unravel the complex signaling pathways - and their relationship to genetic and environmental factors - that contribute to both normal cell function and pathological changes in diseases such as ALS, Alzheimer's and Huntington's disease, as well as cancer and cardiovascular dysfunction.

www.robarts.ca/cellbiology/

Multi-Organ Transplant Program

The Multi-Organ Transplant Program at the London Health Sciences Centre is one of the leading transplant programs in Canada, performing bone marrow, heart, kidney, kidney-pancreas, liver, and multi-visceral transplantation. As well as providing excellent patient care, the program is integrally involved with both clinical research and basic research, aiming to continually improve the lives of transplant patients.

www.lhsc.on.ca/transplant/

Prevention and Early Intervention Program for Psychoses (PEPP)

PEPP is a community focused mental health program which provides prompt assessment and comprehensive, phase-specific medical and psychosocial treatment for individuals experiencing their first episode of psychosis.

www.pepp.ca/

Robarts Clinical Trials

Robarts Clinical Trials, a research group within the Robarts Research Institute, is a centre of academic excellence for clinical research and a contract research organization with proven expertise in conducting multi-centre clinical trials.

www.robarts.ca/clinicaltrials/

Vascular Biology Research Group

The Vascular Biology Research Group at Robarts has its roots in the study of atherosclerosis and cardiac valve biology. It has expanded, however, to encompass approaches in genomics and molecular biology as well as expertise in smooth muscle cell biology, cellular migration and adhesion proteins, and the inflammatory process involved in arterial wall damage including restenosis and transplant arteriopathy.

www.robarts.ca/gateway.php?id=20

Appendix E – Canada Research Chairs in the Schulich School of Medicine & Dentistry

	Areas of Excellence							Emerging Areas					
	Biomedical Imaging	Cancer	Cardiovascular, Respiratory Health, and Metabolic Diseases	Infection & Immunity	Maternal, Fetal, Child and Family Health	Musculoskeletal Health	Neuroscience and Mental Health	Aging and Geriatric Medicine	Clinical Pharmacology and Personalized Medicine	Environment and Health	Genomics, Proteomics and Bioinformatics	Health Services, Delivery and Policy	Population Health
Cellular Communication							X						
Musculoskeletal Health						X							
Oncology		X											
Neurobiology of Motivation and Reward							X						
Neurodegeneration & Stem Cell Regeneration							X						
Neuromuscular Function in Health, Aging, and Disease						X	X	X					
Medical Imaging	X												
Molecular Neurobiology							X						
Fetal and Maternal Health					X								
Human Genetics			X										
Experimental Cardiology			X										
Gap Junctional Intercellular Communication & Disease		X											
Functional Genomics and Cellular Proteomics										X			
Transplantation and Immunobiology				X									
Parallel Magnetic Resonance Imaging	X												
Functional and Molecular Imaging	X												
Fetal/Neonatal Health & Development					X								
Structural Neurobiology							X						
Primary Health Care					X							X	
Infectious Diseases and Microbial Pathogenesis				X									
Bioethics												X	
Genome Bioinformatics										X			
Health Services Research												X	

**Appendix F:
 Strategic Goals for Research: Excerpts from Schulich School of Medicine & Dentistry
 Academic Plan & Strategic Directions 2006-2010**

Schulich Medicine & Dentistry’s Academic Plan and Strategic Directions 2006-2010, *Shaping the Future of Health Care*, identified six strategic directions. Components of the Strategic Plan which impact research are listed below.

Enhance our research capability, productivity and impact

Goals	Actions
Build Schulich Medicine & Dentistry’s capacity and reputation for translational research, facilitating interaction between the disciplines and across the four CIHR pillars of research.	<ul style="list-style-type: none"> • Create a Task Force to study and report on ways to increase interaction among basic science and clinical researchers, which includes: <ul style="list-style-type: none"> - Establish a targeted internal funding stream to enable transdisciplinary research and to develop priority areas - Launch program for environmental scan of researchers and programs - Promote cross-appointments between clinical and basic departments - Provide trainee graduate support (graduate students, postdoctoral fellows) for transdisciplinary research • Communicate and implement key recommendations from the Clinical Research and Education Working Group Report and other consultant reports • Establish and promote effective mechanisms for knowledge transfer • Establish administrative and resource support for knowledge transfer
Strengthen clinician scientist capacity and productivity at all stages of the career path.	<ul style="list-style-type: none"> • Address and implement Clinical Academic Task Force recommendations regarding training, recruitment, fostering new recruits and sustaining clinician scientists • Create an academic development plan for each clinician researcher category • Assign lead role to a research group leader working in collaboration with the Clinical Division/Department • Secure comprehensive and substantial commitment together with the hospitals, monitoring via effective uniform mentoring system and CPD meetings
Establish and maintain Core Platforms for transdisciplinary health research	<ul style="list-style-type: none"> • Establish and maintain up-to-date core research facilities in collaboration with Western and affiliated research institutes • Collaborate with London hospitals, research institutes and Southwestern Ontario hospitals to establish core Clinical Research platforms

<p>Improve Schulich Medicine & Dentistry's and London's competitiveness for major external awards, moving Schulich within the top five schools in Canada for research funding.</p>	<ul style="list-style-type: none"> • Develop a committee of basic, clinical and population/health services research leaders from Western & affiliated research institutes to coordinate national and international grants: • Draw up guidelines for Gap B support for both young & mid-level career faculty • Spearhead successful response to the Clinical Research Initiative from CFI/CIHR & Large Scale Institutional Endeavors from CFI • Target recruitment of new faculty with expertise in translational research in areas of strength and emerging areas • Create a faculty recruitment, career development and mentorship plan for Schulich Medicine & Dentistry and for individual researchers:
<p>Advance Population Health and Outcomes Research and champion the Health Policy Initiative across Western.</p>	<ul style="list-style-type: none"> • Sustain and increase population health and outcomes research by providing resources to support current initiatives, increasing critical mass of researchers and trainee support • Provide leadership to the campus-wide Health Policy Initiative, including advancing the importance of knowledge translation • Strengthen leadership in health policy by providing resources to support current initiatives, increasing critical mass of researchers and trainee support • Establish Inter-Faculty graduate training program in health policy

Expand and enrich our education programs

Goals	Actions
<p>Focus growth in graduate programs to attract high quality students and to prepare students for successful research careers.</p>	<ul style="list-style-type: none"> • Review MD/PhD program and initiate clinician-investigator and residency research program • Provide mentoring to MD/PhD students in integration of degree components and career planning • Explore MSc/MCISc programs in the clinical areas, both medical and dental • Continue to build the Masters and PhD programs, improving program quality as well as increasing the number of students • Institute new graduate programs in Developmental Biology and Clinical Anatomy • Develop more intra-and multidisciplinary programs to maximize opportunities for collaborative research for students, and for funding support • Identify requirements and develop strategies to support increased graduate enrolment, which will require additional space, stipend support, administrative support, etc. Leverage the support of

	<p>the Graduate recruitment office in the Faculty of Graduate Studies</p> <ul style="list-style-type: none"> • Develop a joint recruitment/promotional initiative for all graduate programs in Schulich Medicine & Dentistry • Begin enrolment in the newly established Schulich-Ivey Health Care MBA
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Provide the best student experience

Goals	Actions
Increase summer internships; increase funded research and community/rural placements for students	<ul style="list-style-type: none"> • Based on SRTP model, increase opportunities in other program areas • In collaboration with the Schulich Research Office, establish a program to increase opportunities for medical and dental students to engage in and learn research methodologies

Foster collaboration and integration locally, regionally and globally

Goals	Actions
Optimize the working environment and productivity of clinicians and scientists by leveraging the School's regional placement and strengthening the leadership commitment to collaboration in London and across Southwestern Ontario	<ul style="list-style-type: none"> • Undertake and support joint planning and proposals for shared core facilities
Increase international initiatives and partnerships	<ul style="list-style-type: none"> • Build on new international research collaboration in Israel and South America

Build our infrastructure and funding base

Goals	Actions
<ul style="list-style-type: none"> • Work with University partners to develop an oversight and management structure for core facilities. 	<ul style="list-style-type: none"> • Establish guidelines for recognition, governance and oversight of core facilities. • Complete and inventory of core and research group facilities; identify other needed core facilities • In establishing an oversight structure for core facilities, consider a multi-disciplinary panel to map the city-wide infrastructure needs • New oversight and management structure should consider the following priorities: <ul style="list-style-type: none"> - ensuring appropriate range of facilities - building a sustaining financial strategy - recognition for faculty running a facility - support for facility technicians - improved access to facilities by faculty across Western

