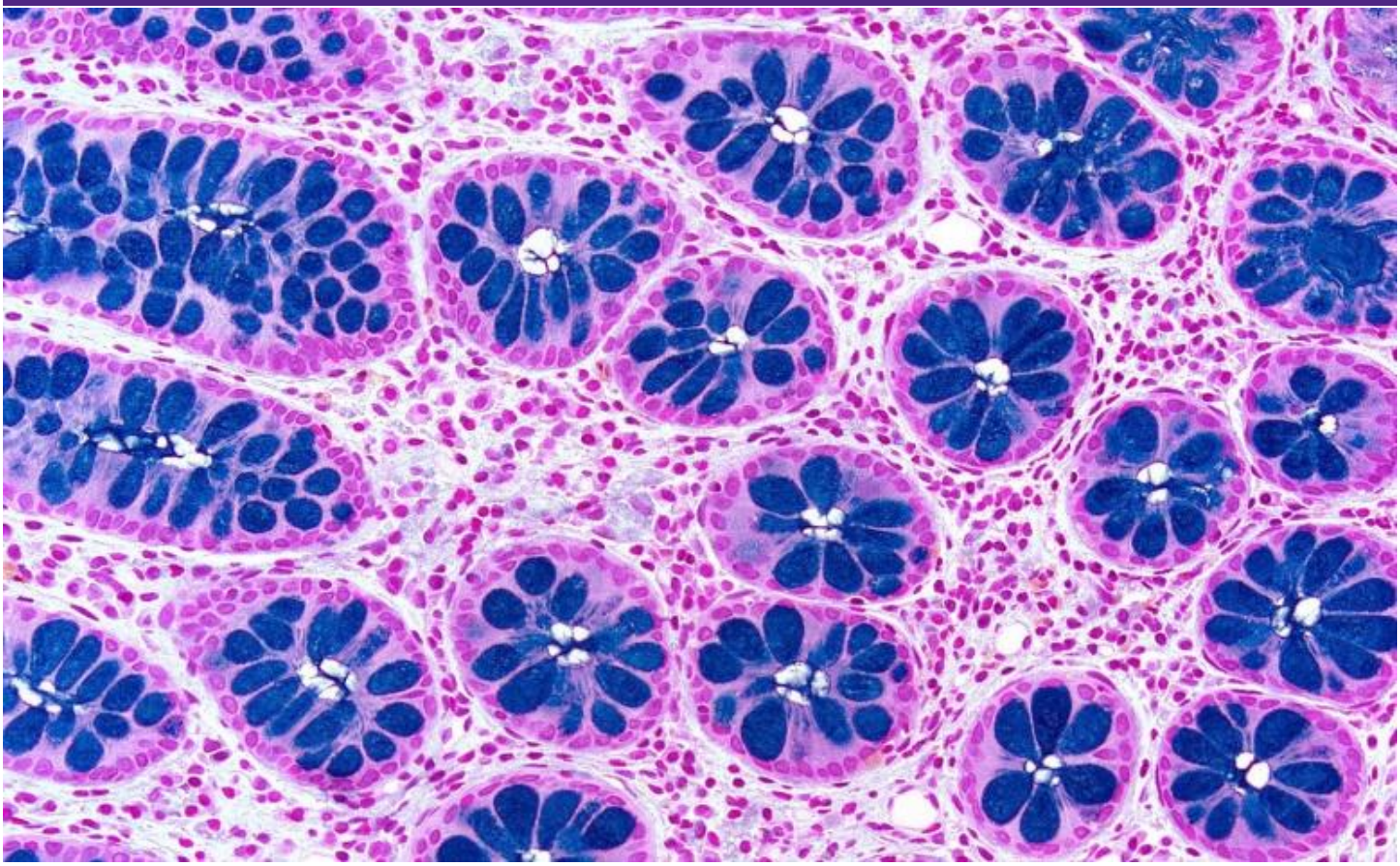
Schulich MEDICINE & DENTISTRY | London Health Sciences Centre | St. JOSEPH'S HEALTH CARE LONDON | Western

DEPARTMENT OF PATHOLOGY AND LABORATORY MEDICINE

Department Self-Study | May 2020



'Seeing small, thinking big'

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1. Executive Summary

As a part of the departmental 5-year review process, a self-study of the Department of Pathology and Laboratory Medicine (PaLM) was undertaken, resulting in the generation of this document. This internal review provides an overview of our department's academic and clinical aspects. As a hybrid department, PaLM has a large presence in the Hospitals as well as in the Schulich School of Medicine and Dentistry both as a clinical and as a basic science department.

From an academic standpoint, PaLM offers education in the undergraduate Bachelor of Medical Sciences Program, undergraduate medicine and undergraduate dentistry. We are also active at the graduate (both professional and research based programs) and post-graduate level. Of note, we have recently started a novel undergraduate program and graduate program field in "One Health".

On the clinical side, PaLM has two programs. The Program of Pathology includes the divisions of surgical pathology, cytopathology, autopsy, molecular diagnostics, and microbiology. The Program of Laboratory Medicine includes biochemistry, hematology, transfusion medicine and transplant.

This document provides an overview of the departmental faculty, staff and resources. It also shows academic and clinical service delivery models. The report captures departmental achievements and challenges during last five years (2015-2019) and charts a course for PaLM's strategic plan over the next five years (2019-2024). Our strategic plan was created in 2018, and for the first time, was developed with input from departmental members on both the clinical and academic sides.

PaLM has much to be proud of, in terms of both of its clinical and academic activities. PaLM is committed to academic and clinical excellence and to provide a nurturing environment for all its members. Along with all academic and healthcare organizations, we faced massive acute COVID19-related challenges and at the time of this report, we are in the midst of it. However, outside COVID, there are areas that are challenged today and may face significant future challenges as a result of increasing demand and resource constraints. It is also recognized that with a changing model of service delivery in Ontario's health care system, there is a potential impact on clinical service delivery and potential impact on our academic activities.

Immediately following this summary, a copy of the last external review report and our response to the report are attached. With all realities in mind, this report represents a post-mortem analysis of activities during the last five years. It also provides an outline of our strategic plan to move forward with both academic and clinical mandates in mind.

The remainder of this document will delineate the self-study in detail.

Appendix E.1: External Review of PaLM (2016)
Appendix E.2: Response to External Reviewers Report

Western University, London, ON
Schulich School of Medicine and Dentistry

Department of Pathology and Laboratory Medicine
External Review
April 11-12, 2016

Reviewer:
Dr. Martin Trotter
Head, Department of Pathology and Laboratory Medicine
Providence Health Care, Vancouver, BC
Clinical Professor, University of British Columbia
Past-President, Canadian Association of Pathologists

Organizational and Clerical Support:
Brigitte Neale, Ashley Thomas, Stacey Gowan

Review Itinerary:
See Appendix 1

Executive Summary

The Department of Pathology and Laboratory Medicine is a unique department within the Schulich School of Medicine and Dentistry at Western University with both a basic science research department and a large clinical department in the London hospitals. While this structure is complex, it allows Pathology and Laboratory Medicine to act as a "connector/integrator" department, facilitating multidisciplinary collaboration and translational research.

Strengths and Accomplishments

The department has made significant progress over the past five years under the leadership of Chair/Chief, Dr. Subrata Chakrabarti.

1. Department restructuring and re-branding. Congregating all laboratory diagnostic services (including pathology, microbiology/immunology, chemistry, and laboratory hematology) within Pathology and Laboratory Medicine is particularly important and conforms with the organizational structure of most Canadian pathology departments. Great early work had been accomplished in re-branding and raising the profile of the department; specifically an improved website, an excellent newsletter and a revamped and highly valued research day.

2. New staff recruitments in basic science/research and in clinical programs

3. Maintenance of strong educational programs. This includes excellence and innovation in undergraduate medical and graduate education, a highly successful and nationally-recognized accredited Pathologists' Assistants program, and leadership in implementation of the competency-by-design paradigm in cytopathology fellowship training. The Anatomic Pathology residency training program is recognized as one of the most rigorous in the country.

4. The Chair/Chief has a supportive mentorship-style of leadership. The review revealed universal strong endorsement of Dr. Chakrabarti, specifically related to advancement/mentorship of staff, facilitation of promotion, and support of both clinical and academic programs

5. Development of “doctor/manager” partnerships. This co-management model is seen to be very successful in improving communication and patient care.

Weaknesses and Risks

The Department operates within a complex, integrated, multi-site academic health sciences centre and large medical/dental school. Several structural limitations exist that place constraints on innovation, research, and recruitment.

1. Department-centric, non-programmatic, non-multidisciplinary approach to strategic planning and funding, most pronounced within the London Health Sciences Centre (LHSC) model

2. Limitations in data management, decision support, strategic decision making, and business case development. The funding model makes it difficult for the laboratory to lead innovative change (e.g. new test development) and more robust business models are needed to justify these tests.

3. Lack of flexibility in recruitment. There is an inability to obtain new positions to support workload/complexity increases and also allow academic productivity. Clinical workload standards/expectations are not part of the employment relationship. Immediate future recruitments should focus on anatomic pathology, hematology, and basic science positions.

4. Budget and strategic planning limitations that have a negative effect on capital equipment acquisition. A strategic capital plan is needed. There is a sense that the department is falling behind with regards to new technology and advances in diagnostic medicine.

Limitations of the review

- Solo reviewer
- Input was not received from all department members (time/space constraints)
- No opportunity to walk-through and review the physical infrastructure of basic science and clinical laboratories

Introduction

The Department of Pathology and Laboratory Medicine is a unique department within the Schulich School of Medicine and Dentistry at Western University with both a basic science research department and a large clinical department in the London hospitals. While this structure is complex, it allows Pathology and Laboratory Medicine to act as a "connector/integrator" department, facilitating multidisciplinary collaboration and translational research.

Dr. Subrata Chakrabarti was appointed Chair/Chief in 2011 and his first term has been considered successful by all individuals and groups interviewed during this process.

This report will focus on administrative structure and leadership, advances over the past five years, and on the health of the three main pillars of an academic medical department – education, research, and hospital clinical programs.

Administrative Structure

- Implementation of Doctor-Manager partnership (co-management model) at all levels of hospital laboratory operations appears to be working well and is assessed favorably from both the administration and medical sides.
- Regular rounding and weekly/daily group huddles were seen as very positive and useful.
- The leadership roles and committee structure are clear and appropriate. Committee chairs were able to clearly explain the role of the committee to the reviewer. There was some minor confusion among new medical/scientific staff re: who to report to for specific issues.
- Support staff levels were not formally assessed but in a combined basic science and clinical department there are clearly workload challenges for the academic department support staff.
- Microbiology and Biochemistry/Immunology are now well-situated in the department. Microbiology is physically located with ideal adjacencies to molecular pathology.
- One major concern for Pathology and Laboratory Medicine is the new London Health Science Centre (LHSC) hospital senior leadership team structure which now apparently lacks any direct input from diagnostic medicine. This grossly undervalues the interconnected and vital role of Pathology and Laboratory Medicine within the hospital including support of patient safety (e.g. infection prevention and control), improvement of patient flow, test utilization and quality.

Advances 2011-2015

The department has made significant progress over the past five years under the leadership of Chair/Chief, Dr. Subrata Chakrabarti.

- Department restructuring and re-branding. Congregating all laboratory diagnostic services (including pathology, microbiology/immunology, chemistry, and laboratory hematology) within Pathology and Laboratory Medicine is particularly important and conforms with the organizational structure of most Canadian pathology departments. Great early work had been accomplished in raising the profile of the department, specifically an improved website, an excellent newsletter and a revamped and highly valued research day.

- New staff recruitments (and replacements) in basic science/research and in clinical programs

  Including:

  - Dr. Martin Duennwald – basic science
  - Dr. Lisa Cameron – basic science
  - Dr. Ping Yang – molecular genetics and cytogenetics
  - Dr. Bekim Sadikovic – clinical molecular genetics
  - Dr. Christina McCord – oral pathology
  - Dr. Nikhil Sangle – anatomic pathology/hematopathology
  - Dr. Joanna Walsh – anatomic pathology
  - Dr. QingYong Xu – transplant immunology
  - Dr. Jeff Fuller – microbiology

- Maintenance of strong educational programs. This includes excellence and innovation in undergraduate medical and graduate education, a highly successful and nationally-recognized accredited Pathologists' Assistants program, and leadership in implementation of the competency-by-design paradigm in cytopathology fellowship training. The Anatomic Pathology residency training program is recognized as one of the most rigorous in the country.

- The Chair/Chief has a supportive mentorship-style of leadership. The review revealed universal strong endorsement of Dr. Chakrabarti, specifically related to advancement of staff, facilitation of promotion, and support of both clinical and academic programs

- Development of “doctor/manager” partnerships. This co-management model is seen to be very successful in improving communication and patient care.

Education

The educational programs within the Department of Pathology and Laboratory Medicine are all highly sought-after and have, or are developing, a national reputation. No major weaknesses are identified in the educational programs, although residency programs are offered only in Anatomic Pathology and Neuropathology, and future opportunities may exist in clinical pathology specialties. Graduate students in Pathology and Laboratory Medicine continue to desire strong integration with the clinical trainees and material. The Western Pathology Association may help in this regard, although the students interviewed did not speak to this directly.

Undergraduate Education

Pathology and Laboratory Medicine is reasonably well integrated into undergraduate programs and curricula. Although there is always an “ask” for more teaching and course commitment, department members, most of whom are active clinicians, are currently carrying high teaching loads.

Undergraduate Bachelor of Medical Sciences

The Department of Pathology and Laboratory Medicine offers several modules in the Bachelor of Medical Sciences Program, including multidisciplinary Honors Specialization modules.

One Health

One Health is a new interdisciplinary program (expected to start September 2016) that breaks down Faculty, Department, and School barriers, again providing Pathology and Laboratory Medicine with the opportunity to connect and integrate education and training across disciplines.

Undergraduate Medical Education

Three pathologists serve as course chairs in the Meds I and Meds II curriculum. Innovative integrative teaching methods are being used in the Meds III and Meds IV curriculum to introduce medical students more intimately to the laboratory and the practice of pathology and laboratory medicine. New pathology and laboratory medicine topics have been introduced into the mandatory Meds IV Integration and Transition course and into the Physicianship course.

Undergraduate and Postgraduate Dentistry

Five courses in pathology and oral pathology are offered to undergraduate and postgraduate dental students

Graduate Education

Research-based Graduate Education

Dr. Chandan Chakraborty is providing good leadership and oversight to these programs. MSc and PhD degrees are offered. One Health (see above) will also integrate graduate study programs. Many pathology and laboratory medicine graduate students have more than one direct supervisor and this provides an excellent interdisciplinary perspective to their studies. There continues to be a faculty-wide call to accept more graduate students.

Masters of Clinical Science Pathologists' Assistant Program

This program, established in 2007, although relatively small, is a flagship educational program for the department. It is the first PA program in Canada to be accredited The department should continue publicize this program and its success.

Postgraduate Medical Education

Two strong residency programs and two fellowship programs exist within the department. With the full integration of clinical laboratory medicine into the department there is great opportunity to explore the re-establishment of post-graduate programs in these areas. Given the size of the regional population served, a needs assessment should be considered to determine if residency programs in medical microbiology and hematopathology are appropriate. Training of PhD Clinical Chemists could also be considered.

Anatomic Pathology Residency Training Program

The AP residency program is a strong and well-recognized nationally. It is seen as one of the most demanding and rigorous training programs in the country (and RCPSC exam success supports this).

Neuropathology Residency Training Program

This is also a strong program, accredited in 2012, which also supports the mandatory neuropathology training component of the AP program.

Surgical Pathology Fellowship

Funded post-residency fellowship programs are still relatively few in Canada and this surgical pathology fellowship provides excellent additional training. The main threat is lack of a reliable, sustained funding source for this program and some space issues for the fellows.

Cytopathology Fellowship (AFC Diploma in Cytopathology)

Although, again, the absence of secure funding presents a threat to this program, the Cytopathology Fellowship is unique in its design and transition to competency-based education. An internal review will take place this year (2016).

Continuing Professional Development (CPD)

The three main department-organized CPD events are Grand Rounds (every other month), CME Update (alternate years), and Research Day (see below)

Research

Basic, translational, and clinical research is facilitated and overseen by the research committee and Dr. Zia Khan, Director of Research. Overall, the department is building a solid basic science research program with good interdisciplinary collaborations. There is a gradually improving modest production of high quality clinico-pathologic and quality assurance research, and an emerging interest in education research. As mentioned previously, Pathology and Laboratory Medicine is seen as a "connector" department, and is ideally placed to facilitate and participate in translational and multidisciplinary research.

Research Committee

The goals of the research committee are to enhance research capacity, research profile, and collaborations among departments. The committee members also have a mentorship role for students and young investigators.

Role of Department Chair

Dr. Chakrabarti is seen as a major influence in the developing success of research in the department and improving overall academic output:

- New investigators recruited into the basic science research stream
- Encouragement of intra-department and inter-departmental collaboration
- Encouraging department members to accept and mentor graduate students; facilitates joint appointments with other departments to allow this
- Much higher quality/standard of research
- Good linkages between oral pathology and dentistry

Limitations/Weaknesses

This review revealed several limitations/weaknesses in the research sphere:

- Limitations/availability of new laboratory space
- Limited ongoing funding to support co-appointed researchers
- Lack of instrumentation/equipment within department laboratories – inconvenient and also somewhat intrusive for the other investigator. There has been some improvement in collaborative equipment/infrastructure submissions.
- Lack of a consolidated region-wide bio-banking initiative (see below)

Opportunities

Within the research endeavor, the department is uniquely positioned to take a leadership role in several areas:

- Regional bio-banking. Currently tissue banks in the region are stand-alone and often research focus-specific. As a present and future resource for translational research, a consolidated bio-bank, likely integrated virtually for specimen integrity, privacy, and data management is best coordinated under the umbrella of Pathology and Laboratory Medicine.

- Health economics and resource utilization research. Especially in the clinical laboratory areas of hematology, chemistry, and microbiology, the department, in concert with other academic partners, can play a major role in this type of important research.

- Research in Medical Education. Dr. Michelle Weir and others are already taking the lead in this important area of research. As post-graduate medical education moves to a competency-based format, there is enormous opportunity for productive research in this area, given the strength of the training programs at Western. If focus is continued in this area, then investigators will need resources, including protected time within an accountability framework, to realize good academic productivity.

Hospital Clinical Programs

The clinical service of the department takes place at London Health Sciences Centre and at St. Joseph's Health Care. Administratively there are two programs:

1. Program of Pathology
   Surgical pathology, Cytopathology, Autopsy, and Molecular Diagnostics.

Microbiology has recently moved to within this program, an unusual structure but one that aims to leverage the relationship between Microbiology and Molecular Diagnostics.

2. Program of Laboratory Medicine
   Hematology, Biochemistry and Immunology, Transplant Immunology, Pulmonary Function Lab.

The large volume of clinical material and high complexity of testing is a double-edged sword for the department. While the clinical material greatly enhances the ability to do high quality clinic-pathologic and translational research, the clinical workloads are extremely high for the department's pathologists and laboratory physicians, impairing their ability to participate in research endeavors. The funding model does not easily allow for increased clinical staffing and there is no workload/workforce model in place to determine appropriate laboratory physician staffing in this highly complex academic department.

Comments by Specialty

Surgical Pathology

This is a strong service with good subspecialty coverage. Workloads are high and there is limited time for research. Teaching commitment remains strong. There appears to be no transfer of funding to the laboratory when clinical programs expand and greatly impact the laboratory. For example, a large increase in gastrointestinal biopsies, in part due to expansion of colon screening programs, has not resulted in fund transfer for the additional pathologist(s) needed to interpret these biopsies. There are also some infrastructure-related risks that were identified by division members:

- Lack of a positive patient identification (PPID) specimen tracking system for anatomic pathology
- Limitations of synoptic reporting in Cerner PathNet (lack of mandatory fields) make adherence to reporting guidelines difficult.
- Frustrations with accuracy of voice-recognition software

Cytopathology

This is another strong service with recent expansion to provide support for regional hospitals and also a highly valued and well-utilized rapid on-site evaluation service.

Autopsy

This includes hospital autopsies and the regional forensic pathology unit. This service is seen as functioning extremely well under the leadership of Dr. Shkrum. The main

challenge is increasing number of regional cases transferred to London as smaller hospitals stop providing on-site autopsy services. This has resulted in very high workloads for this group.

Molecular Diagnostics

This division comprises biochemical genetics, cytogenetics, and molecular genetics (including Molecular Pathology). Dr. Joan Knoll is providing excellent leadership and direction to this section. Testing platforms and technology in molecular diagnostics change rapidly and a major challenge for this division is keeping pace with new developments especially in automation and next generation sequencing. There appear to be limited sources of capital funding and no obvious capital equipment strategy at LHSC (St. Joseph's Hospital has a more coherent capital plan).

Microbiology

Recruitment of two new microbiologists into this division will have a very positive impact. Dr. Fuller will start his position on April 18, 2016. The sense within the department and among hospital administration is that Microbiology "has turned the corner" after some challenges. The 2013 external review of the Divisions of Clinical Microbiology and Infectious Diseases was reviewed. As noted above, positioning of Microbiology within the Program of Pathology is unique and innovative.

Hematology

Hematology/hematopathology supports the core laboratories at all hospital sites. There is also a Blood Transfusion Laboratory and a special ("investigational") hematology lab. Medically this division is staffed entirely by clinical hematologists without laboratory physician hematopathologists. Despite having one of the largest blood banks in Ontario, there is no fellowship-trained specialist in transfusion medicine, although the service appears well-covered by the existing expertise. Hematology appears understaffed relative to several other comparable centres in Ontario. The Division lead, Dr. Ian Chin-Yee, has now take also taken on the position as Laboratory Medicine program leas, adding to his administrative and clinical responsibilities. The 2013 external review of the Division of Hematology, Department of Medicine was reviewed.

Biochemistry and Immunology

With the move of Clinical Chemist academic appointments from Biochemistry to Pathology and Laboratory Medicine, this Division is now better integrated into the clinical department. In general this division is operating reasonably well. There were some concerns expressed from the basic science Biochemistry group regarding inability to validate new tests and add these test to the laboratory menu. The current funding

structure and lack of coordinated business case development restricts new test development and implementation. Several of those interviewed asked how the laboratory could become a revenue-generator (e.g. billing for new tests, private contracts, etc.)?

Transplant Immunology

Dr. Qingyong Xu is now providing leadership to this program.

Summary and Recommendations

The Department of Pathology and Laboratory Medicine has had several important advancements and successes over the past 5-years including department restructuring/rebranding, new staff recruitments, maintenance of strong educational programs, and a implementation of “doctor-manager” administrative partnerships. The Department Chair/Chief, Dr. Chakrabati, is seen as strong leader, an effective mentor, and a quiet but firm voice advancing the interests of the department. He is well-respected within the hospital, the university, and nationally for his leadership style and accomplishments.

The major department weakness is in research/academic productivity, but this has been an area of emphasis of the current chair and there are clear signs of gradual significant improvement in this area. Organizational structure issues have been dealt with effectively through department reorganization and full merging of pathology and clinical laboratory medicine.

The main opportunities for the department are as a “connector” translational department due to its unique position within the medical school. Examples would include leadership in interdisciplinary strategic planning, biobanking, infrastructure acquisition, data management, and translational research.

The most important threats to the department are inflexible funding models, infrastructure limitations, and high clinical workloads. These will place constraints on innovation, research, and recruitment.

Martin J. Trotter MD, PhD, FRCPC
April 29, 2016

Response to External Review of the Department of Pathology and laboratory Medicine, Western University and
London Health Sciences Centre, St. Joseph's Health Care

The department would like to sincerely thank the external reviewer for this report. This response is the result of extensive consultation within the departmental executive committee and several other members. This response reflects the general opinion of many, not just the current Chair/Chief. We feel that the reviewer has been able to capture key aspects of the departmental activities, strengths and weaknesses. We also recognize some of the limitations of this review as noted by the reviewer (eg. solo reviewer, no chance to meet with all departmental members and walk through the physical space). We appreciate that the reviewer identified many positive aspects of our department. However, the department urges the local institutional leadership (both hospital and university) to respond to the concerns raised by the reviewer and highlighted in this departmental response.

Below are our responses to the specific comments (#1-6 are largely related to our Hospital department and #7 is related to the University department):

1. **Department-centric, non-programmatic, non-multidisciplinary approach to strategic planning and funding, most pronounced within the London Health Sciences Centre (LHSC) model**

   Response: This is a structural challenge of the hospital and the university system of a complex multisite academic health center. We agree that a programmatic strategic model would be more efficient. Our department would support a programmatic approach that would integrate diagnostics into clinical operational planning.

   Specific action plan: Such initiatives require a significant commitment for change from Hospital senior leadership. We are willing to work with Hospital and University Leadership towards this goal.

2. **Limitations in data management, decision support, strategic decision making, and business case development. The funding model makes it difficult for the laboratory to lead innovative change (e.g. new test development) and more robust business models are needed to justify these tests.**

   Response: Department agrees with this observation and with the difficulties in developing state of the art diagnostics. In spite of the limited support / resources available, PaLM has taking some initiative to develop new tests (eg. molecular diagnostics). However, so much more could be achieved to advance patient care, if appropriate capital and operating resources were available.

Specific action plan: We will continue to identify such resources inside the system and work with them. The hospital senior leadership needs to support the appropriate use of current tests and a process for introducing new tests. This should occur in collaboration with professional staff (MAC).

3. **Lack of flexibility in recruitment. There is an inability to obtain new positions to support workload/complexity increases and also allow academic productivity. Clinical workload standards/expectations are not part of the employment relationship. Immediate future recruitments should focus on anatomic pathology, hematology, and basic science positions.**

   Response: This is an ongoing challenge which will be a major issue going forward. Our limitation is the LMFFA agreement and the challenge of ever-increasing clinical workload for which there is no direct accounting in terms of resources. For eg., during the last 5 years there is approximately 12-15% increase in surgical pathology and autopsy workload. However, during the same period there has been no increase in professional resources. If the lack on investment in professional staff continues, the clinical service may be unsustainable in the future. We have been successful in continuing recruitment in Basic Sciences. However, we need close interaction and resource support from hospital leadership in the clinical areas.

   Specific action plan: We will continue to bring this issue to the attention of Hospital leadership. The hospital needs to fund an appropriate number of professional positions to support the clinical workload. There is an immediate need to fund at least one additional pathologist position

4. **Budget and strategic planning limitations that have a negative effect on capital equipment acquisition. A strategic capital plan is needed. There is a sense that the department is falling behind with regards to new technology and advances in diagnostic medicine**

   Response: This is an ongoing challenge in our hospital department and has a negative impact on our performance. Simply put, we lack proper tools to work at maximum efficiency (please see also #7). A strategic plan regarding capital renewal will be of help particularly in the environment of limited resources.

   Specific action plan: We will continue to bring this issue to the attention of Hospital leadership and identify alternate mechanism(s) of acquiring capital equipment.

5. **Specific issues: Laboratory Medicine: The review acknowledges the urgent need to hire a transfusion medicine specialist to support clinical needs**

Response: Department has been advocating for such a specialist for more than 4 years. Transfusion Medicine requires immediate attention from the hospital leadership. *Specific action plan: We will continue to bring this issue to the attention of hospital leadership and work with them to find a solution. The hospital needs to fund an*

appropriate number of professional positions to support the clinical workload. There is an immediate need to fund a transfusion medicine specialist

6. Specific issues: Surgical Pathology

Response: The review identified three major challenges: eg. Specimen tracking system, synoptic reporting in Cerner and challenges with voice recognition system.
We agree with these observations. All three are long standing issues that limit our effectiveness and quality and have been raised with the hospital leadership. We need urgent attention in this area.

Specific action plan: We will continue to bring this issue to the attention of hospital leadership and work with them to find a solution.

7. Weakness in the research sphere

Limitations/availability of new laboratory space. Lack of instrumentation/equipment within department laboratories.

– Inconvenient and also somewhat intrusive for the other investigator.

Response: The department has been successful in recruiting several researchers and trying to secure additional space in the University. We are also in the process of recruitment of a Canada Research Chair and an Endowed Chair. These positions usually attract new funding (eg. CFI etc.). Some of this may improve the quantity and quality of laboratory space. In addition, we have been able to competitively obtain University funding to improve some of our existing research space. One of the challenges is the physical space where several of our research scientists are located (4th floor DSB). This is an old building with dated laboratory setup. We would also like to point out that PaLM is probably the only Schulich department who didn't benefit from the MSB renovation few years ago. It is important to note that Pathology and laboratory Medicine is the only department at Western that offers undergrad, grad, professional grad, and postgrad education – with possibly the smallest faculty complement. We are however trying to establish multiuser facilities to improve effective use of space. We have also been active in applying for equipment funding whenever such announcements are made. Some of such initiatives have been successful. Because of our multi-disciplinary research, equipment needs of individual researchers are quite different. We have also been able to establish a number of core facilities. Department fully supports researchers in their individual/unique equipment funding applications

Specific action plan: Schulich and Western University need to address issues related to physical space. Department will continue to work with Schulich and Western University to identify and fulfill our needs

Limited ongoing funding to support co-appointed researchers:

Response: We are uncertain of what this comment is implying. The department follows university guidelines and respects all existing contracts.

Lack of a consolidated region-wide bio-banking initiative:

Response: We suspect that the biobanking processes supported by our department were not sufficiently clarified during this review. PALM is the largest contributor for tumour samples to the province wide Ontario Institute for Cancer Research tumor bank. This effort is led by one of our Pathologists and involves the ongoing efforts of 2 employees. In addition on request, we provide tissues to the individual researcher through our Tissue and Archives procedure).

Specific action plan: We will continue with our current efforts.

Health economics and resource utilization research:

Response: We have recently recruited a researcher in this area. We have also developed a new One Health program (September 2016 launch) which encompasses health economics and resource utilization research.

Specific action plan: We will continue current direction to expand in this area

Research in Medical Education:

Response: As noted, we have initiated research in this area. A discussion forum (NERD) has been formed to exchange ideas. We agree with the identified challenges.

Specific action plan: We will continue to support and expand this endeavor,

Respectfully submitted on behalf of the Pathology and laboratory Medicine department, London Health Sciences Centre, St. Joseph's Health Care and Western University.

Subrata Chakrabarti

May 15, 2016

1.1 Key Events (2015-2019)

a) Strategic Planning: A new combined strategic plan was developed for the first time in 2018.
b) Faculty Recruitment:

Dr. Ana Cabrera (New)
Dr. Matt Cecchini (Replacement)
Dr. Ian Chin-Yee (New-Moved from Medicine)
Dr. Fred Dick (New-Moved from Biochemistry)
Dr. Stephanie Frisbee (New)
Dr. Jeffery Fuller (Replacement)
Dr. Emily Goebel (Replacement)
Dr. Rebecca Jacques (New)
Dr. Patti Kiser (New)
Dr. Michael Knauer (Replacement)
Dr. Hanxin Lin (New)
Dr. Christina McCord (Replacement)
Dr. Francisco Olea-Popelka (New)
Dr. Anahita Meybodi (New)
Dr. Michael Payne (Replacement)
Dr. Paul Plantinga (Replacement)
Dr. Art Poon (New)
Dr. Laila Schenkel (New)
Dr. Parisa Shooshtari (new)
Dr. Ziad Solh (New)
Dr. Ian Stevic (New)
Dr. Cady Zeman-Pocrnich (Replacement)
Dr. Qi Zhang (Replacement)
Dr. Liena Zhao (Replacement)
New position in cardiovascular Omics (recruitment in progress)

c) International business development in Molecular diagnostics
d) Partnerships with regional sites (Ingersoll, Tillsonburg, Windsor, Chatham, Woodstock)
e) Continuation of information exchange processes for better decision-making including:
    - Regular rounding of all our labs
    - Weekly and/or daily Group Huddle
f) Organizational structure
    - Doctor-Manager partnerships at all levels of hospital laboratory operations
g) Extensive expansion of operations in molecular diagnostics
h) Implementation of mtuitive for surgical pathology
i) Implementation of OMNI document management system
j) Transformation of all clinical laboratories (2017-2018)
k) Transformation of anatomical pathology laboratories (2019-2020)
l) Transformation of microbiology (2019-2021) including total lab automation
m) Improved voice recognition system
n) Implementation of Choosing Wisely process
o) Merger of biochemical genetics laboratory with molecular genetics and clinical chemistry
p) Implementation of One Health educational programs (First in Canada)
q) Anatomical pathology residency program continues 100% pass rate at Royal College exams

r) Proposal and implementation of Graduate Diploma in Pathology (ongoing)
s) Proposal of Clinical and Translational Science Graduate Diploma (ongoing)
t) Revamping of research and graduate programs with recruitment of new scientists
u) Microbiology's response to COVID testing for hospital and region

2. Chair's Report

The Department of Pathology and Laboratory Medicine underwent its last self-study and external review in 2014-15. Since our last self-study, several changes have occurred. This report highlights our achievements, our challenges and our future directions.

In 2015, Dr. Subrata Chakrabarti's appointment as Chair of the Department of Pathology, Western University; and Chief of Pathology and Laboratory Medicine, London Health Sciences Centre and St. Joseph's Health Care, was renewed for a five-year term.

In 2018, a new combined strategic plan was developed and for the first time, the process involved both hospital and university stakeholders. The departmental plan aligns with the strategic plans of the Schulich School of Medicine & Dentistry, Western University, London Health Sciences Centre and St. Joseph's Health Care. Through this process, we renewed our commitment to excellence in research, education, clinical service delivery, and in staff and faculty development. Our plan is also aligned with our achievement over the last few years, which have been outlined in this document. A copy of our strategic plan is provided in Section 4.

Outlined below are a few highlights. As will be evident from this report, our department is on solid ground. However, we thrive for innovation and progress. We will follow our strategic plan.

Recruitment

Over the last five years, with support from the Schulich School of Medicine & Dentistry and the London Health Sciences Centre, we have been able to recruit 23 faculty members. These include basic scientists (PhD), microbiologists, pathologists, cytogeneticists, hematologists, and molecular geneticists. The majority of these recruitments were new, full-time positions. A list is provided in Section 1.1.

Achievements from an Academic and Research Perspective

Since 2015, our academic programs have evolved while continuing to maintain their high standards of excellence. Our faculty recruitment in the last few years is reflected in enhanced research and educational activities. Some specific initiatives worth mentioning:

Academic Programs

Since 2015, our academic programs have evolved while continuing to maintain their high standards of excellence. Some specific initiatives worth mentioning:

- We have developed and launched an undergraduate module and a graduate program field in One Health. One Health has generated significant student interest and faculty members are equally enthusiastic. However, so far, we have not been able to secure any resources from the Schulich School of Medicine & Dentistry or Western for this novel initiative. Such resources are needed for long term sustainability of this program.

- Our undergraduate Honours specialization modules in the Basic Medical Sciences Program are extremely popular and attracts and retains high caliber students.

- Both our research-based graduate program and our pathologists' assistant program are healthy and continue to attract high quality trainees.

- We are implementing a new Graduate Diploma in Pathology and exploring next steps for a Graduate Diploma in Clinical and Translational Science.

- Our anatomical pathology residency program continues to thrive and has demonstrated 100% success rate in the Royal College exam for the past 28 years.

- We continue to progress with Canada's first Royal College-approved Cytology AFC diploma program and our fellowship training in anatomical and surgical pathology.

- Our faculty have demonstrated leadership in curriculum development in undergraduate medicine, dentistry, undergraduate basic medical sciences, graduate and post-graduate programs. Some of these achievements will be detailed in Sections 5-7: Education.

Continuing Professional Development (CPD)

During last few years, we are carrying out CPD activities with renewed vigor. We continue to do regular research seminars and have started web-casting our grand rounds. We are also providing more fay-long CPD events as will be discussed in Section 8: CPD.

Research

Our researchers continue to be productive and engaged. In addition the level of productivity of our clinical faculty continues to be impressive. Our residents and graduate students are encouraged to present at national and international conferences. Our research success and impact are reflected in the PI funding we receive from external funding agencies and our publication record in peer-reviewed journals.

Our research commitment is also reflected in our willingness to provide protected time for clinical academics. Several of our faculty members are recognized nationally and internationally for their research and our international activities attract externally funded researchers to our department. In Section 9: Research, we will highlights our collective achievements and challenges in the research sphere.

Biobank

As part of our sustained commitment to research, we continue to operate, and serve as the highest contributor to, the Ontario Tumour Bank. We also continue to support local researchers through our tissue and archives committee.

Achievements from a Clinical Perspective

Communication and Feedback

To deliver complex health care in our hospitals, we have developed a model of "doctor/manager" partnerships. As is evident from our organizational chart, such partnership facilitates the exchange of ideas and improved strategic decision-making. On the clinical side, we have initiated "rounding." Through this process we solicit input from front-line staff to inform decision-making at all levels.

Service Volume

The Department of Pathology and Laboratory Medicine at London Health Sciences Centre (LHSC) and St. Joseph's Health Care London (SJHC) is one of the largest laboratories in Canada. It is home to (in FTE) 28 anatomical pathologists, 3 neuropathologists, 2 oral pathologists, 6 clinical chemists, 4.5 microbiologists, 2 hematologists, 4.5 cytogeneticists/molecular geneticists, and 1 transplant immunologist. The department also has 497 technical and administrative staff members.

Therefore, as expected, it carries a huge service workload. For 2019, clinical workload of PaLM is outlined in Table 1 below:

Table 1	2019 Volume
Autopsies	716 (595 coroner cases and 121 hospital cases)
Biochemical Genetic Tests	7,072
Blood Transfusion-Related Tests	113,398
Clinical Chemistry Tests	6,208,060
Cytogenetics and Molecular Genetics Tests	20,490
Cytology Specimens	20,798
Hematology Tests	590,036
Microbiology Tests	248,015
Surgical Pathology Specimens	60,394
Transplant Immunology Tests	169,566

Governance

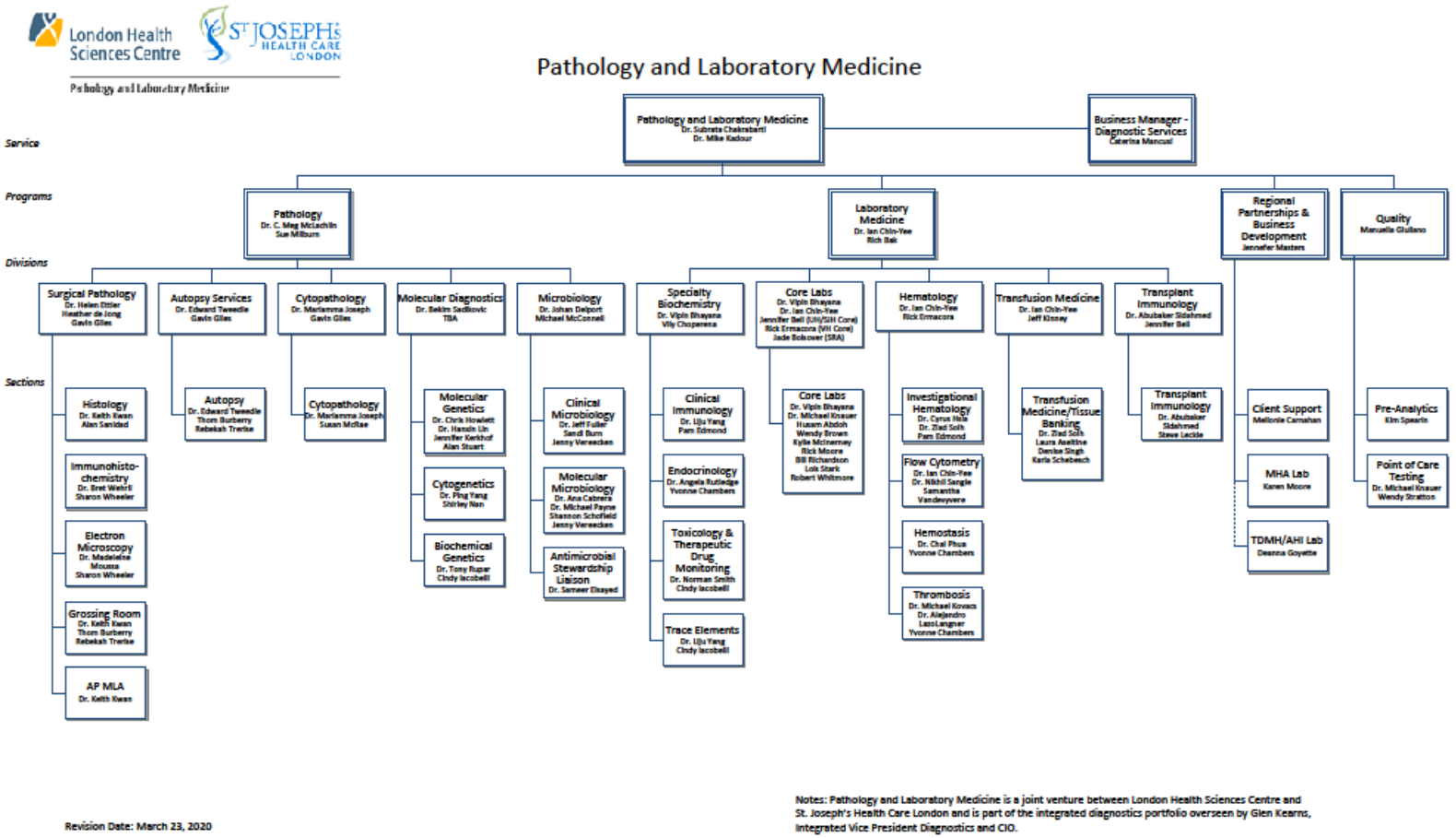
As is evident from our organizational chart **(Figure 1),** these services are offered through two large programs, namely Pathology and Laboratory Medicine. Under each of these programs there are multiple divisions. Each division has multiple laboratories with specific functions, and at every level, we have implemented doctor-manager partnerships. We strongly believe that such a model is necessary for smooth functioning of the laboratories. At the leadership level, we have two forums for information exchange and decision making.

- PaLM SLT: The Senior Leadership Team (SLT) is comprised of a Senior Medical Director, VP Laboratory Services, Departmental Chair-Chief, Administrative Director, Program Chiefs and Program Managers.
- Individual divisions have their meetings with Chiefs and Coordinators. The Division Chiefs report to SLT monthly.

Our staff at all levels are empowered and involved in decision-making and CQI. Saying "our doors are open" is not good enough; rather we need to reach out and create opportunities for feedback. For this reason, we implemented "rounding", whereby the Departmental Chief and Administrative Director visit every laboratory individually and discuss the concerns of the front line staff directly. Feedback is provided to the respective leaders and actions are taken. We also carry out open town hall type of meetings with all departmental members on a regular basis.

We model communication and transparency at all levels. In addition to formal meetings, we carry out regular (sometimes daily) "huddle". Huddles are brief "check-ins" to discuss workflow, news, and solicit peer support as needed.

Figure 1: LHSC Organizational Chart



Summary of Challenges

Overall, our strength is our people. We have a motivated and highly committed group of individuals with a high level of expertise. This is true for our physicians, scientists, academic/research faculty, technical and administrative staff. In addition, our open communication at all levels is a strength.

However, on the academic and research side, our primary challenges include dwindling research funding and changing CIHR funding mechanisms as well as adequate space to conduct research.

On the clinical side, our greatest challenge is that we are unable to regulate our workload. A change in the practice of other physicians and/or disciplines has a direct impact on our workload. Similarly, a change in government health care policy or new physician recruitment in the hospital may have a significant impact on our workload as well. The increased complexity of testing along with limited resources poses additional pressure.

2.1 Information on Clinical Service Mandate

The section will focus on the department's response to the request from the hospitals to provide additional information on our clinical service mandate, specifically:

A. Strengths and weaknesses from a clinical perspective
B. Ability to meet clinical demands
C. The adequacy of hospital resources
D. The quality and relevance of clinical services provided to patient care
E. Overview of how clinical quality is measured

A. Strength & Weaknesses from a Clinical Perspective

Outlined in the previous section.

B. Departmental Ability to Meet Clinical Demands

Clinical Service remains the busiest operation of the department. On the clinical side, we are so far coping reasonably well to meet demands. However, we are stretched to the limit and any resource reduction may lead to significant inability on our part to meet our clinical demands. As an example, we have modeled impact of budget cuts on surgical pathology in Figure 2 below.

A test of our commitment to meet clinical demands occurred during the COVID-19 pandemic. Our physicians, scientists and staff rose to the occasion, adapted, accepted the challenge and delivered extremely well.

However, meeting clinical demands in surgical pathology remains an ongoing challenge. Increasing volume and case complexity as well as a governmental decision not to increase LMFFA funding for laboratory physicians since 2012, has contributed to the current state.

Moving forward, other divisions need additional resources, namely microbiology and hematology. For microbiology, the ***recruitment of an additional microbiologist*** is essential to address our current needs (i.e. increasing volumes, new regional initiatives, and providing infection control services for LHSC). Regarding hematology, compared to other hospitals in Ontario, we have fewer laboratory hematologists. In spite of the recruitment of Dr. Ziad Solh in 2017, our regional initiatives require ***recruitment in additional hematopathologists***.

Overall, the workload of the Pathology and Laboratory Medicine programs show steady increase. Complexity of our specimens and pressure from external agencies (CCO, IMQH) continue to exert steady pressure on our workload. Specific examples of increased workload in our labs are depicted in Figures 3-5 below. This is producing steady pressure on workload. Although such data positions us well to make the case for future recruitment, the current provincial funding model may not allow us to do so.

Figure 2

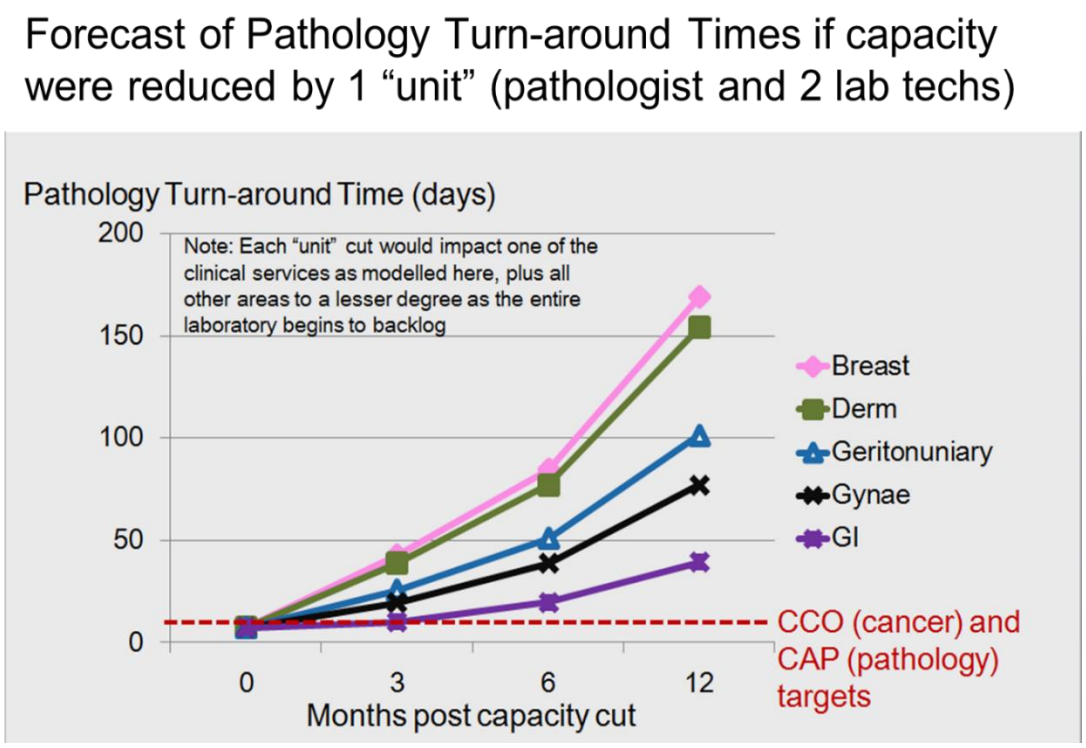
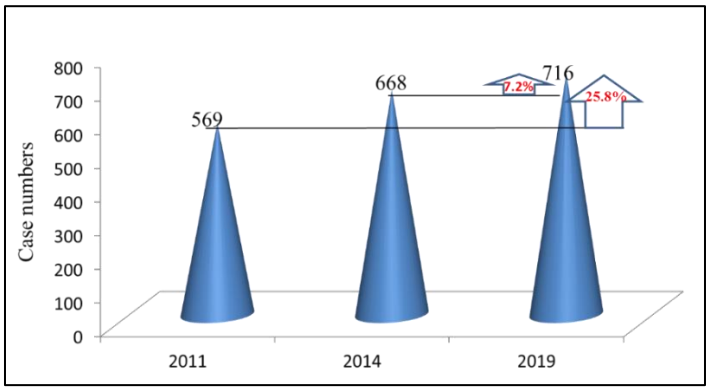
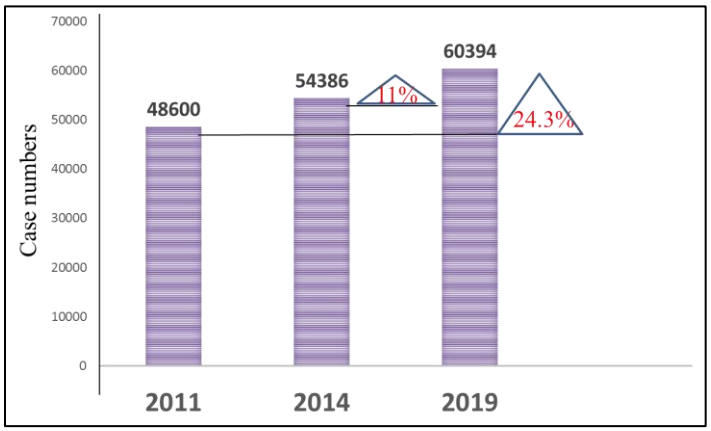

Forecast of Pathology Turn-around Times if capacity were reduced by 1 "unit" (pathologist and 2 lab techs)
Pathology Turn-around Time (days)
200
150
100
50
0
Note: Each "unit" cut would impact one of the clinical services as modelled here, plus all other areas to a lesser degree as the entire laboratory begins to backlog
0
3
6
12
Months post capacity cut
Breast
Derm
Geritonuniary
Gynae
GI
CCO (cancer) and CAP (pathology) targets

Figure 3 Surgical Pathology 2011-2019



Autopsy 2011-2019



Cytology 2011-2019

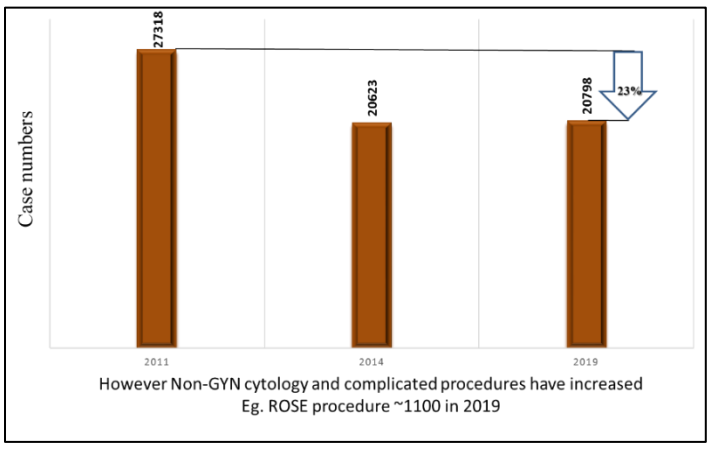
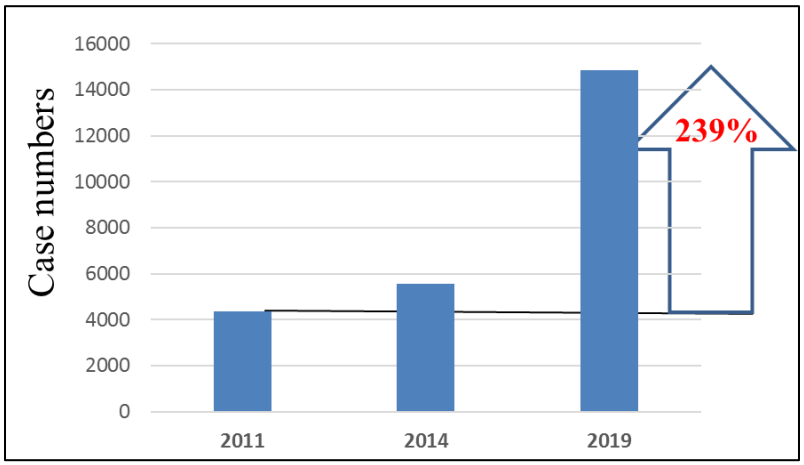
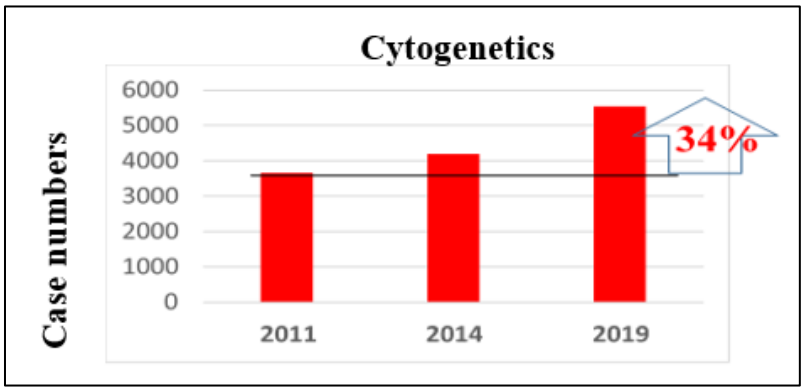


Figure 3: Bar graphs showing increased volume in surgical pathology, autopsy and cytology 2011-2019

Figure 4 Molecular Genetics 2011-2019



Cytogenetics 2011-2019



Biochemical Genetics 2015-2019

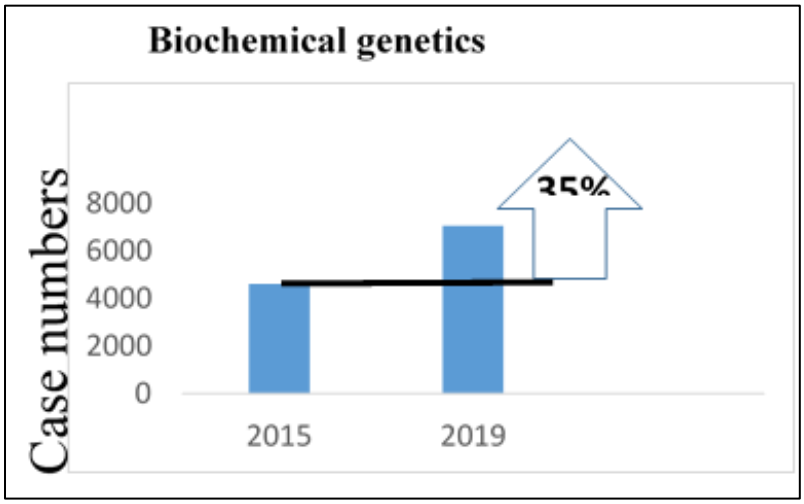


Figure 4: Bar graphs showing increased volume in molecular genetics, cytogenetics and Biochemical genetics tests 2011-2019

Figure 5

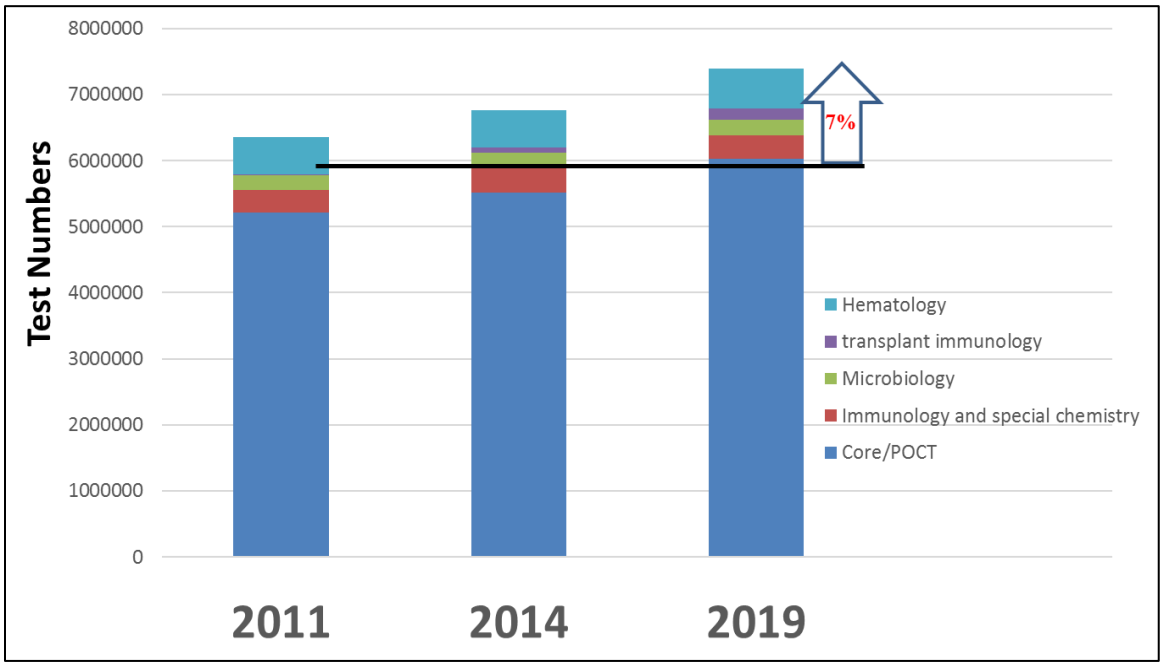


Figure 5: Bar graphs showing increased test volumes in various disciplines of laboratory medicine 2011-2019

C. Adequacy of Hospital Resources

As previously mentioned, our pathologists are stretched to capacity. In addition, specific areas of medical microbiology and hematology need further attention. In other areas, although we are coping, the system has very little buffer. The situation is further under pressure due to reduction in the compensation levels for the laboratory physicians. Some of the new initiatives in the hospital system (transformation) will be of significant help.

On a related note, due to lack of sufficient academic/faculty resources on the University side, our physicians are being called upon to teach more frequently. While their performance as educators is exemplary, it does impact overall research productivity. We are committed to overcoming these limitations, however under the current circumstances, only limited growth in research productivity is possible. Another major challenge is availability and retention of trained laboratory technologists.

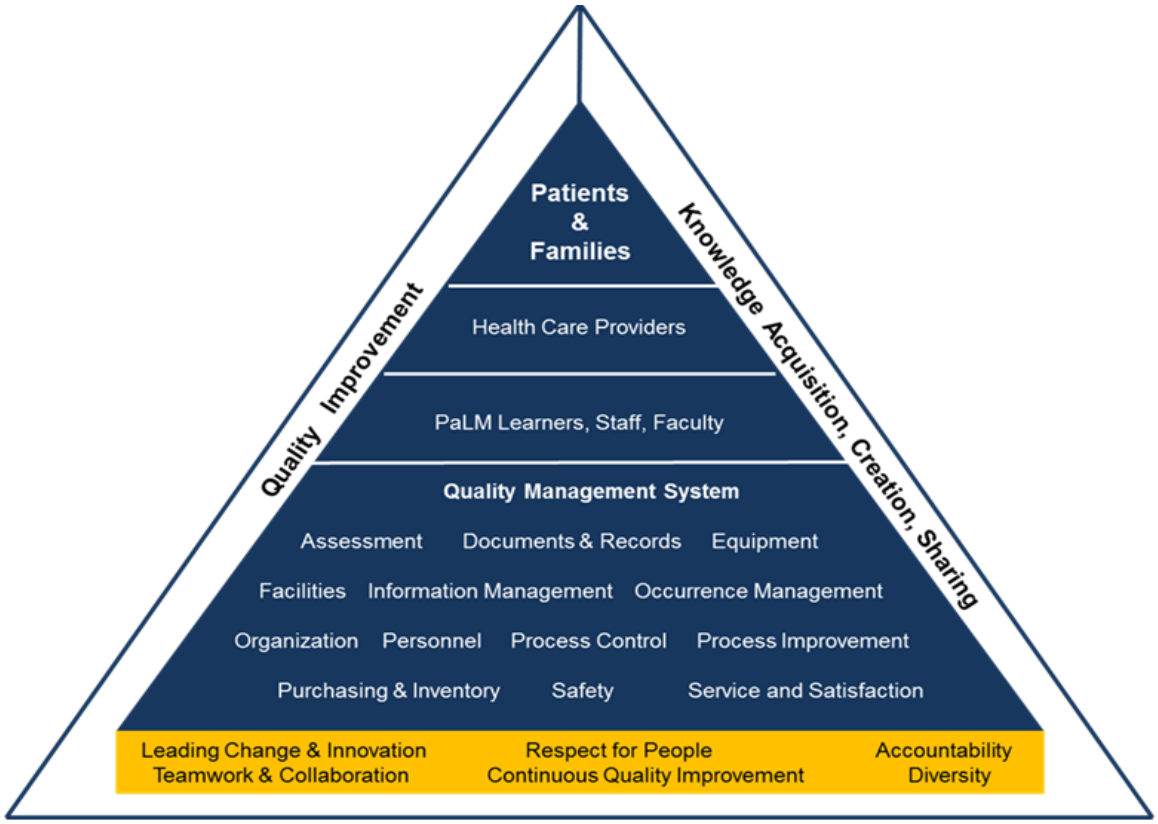
In surgical pathology, we are implementing significant process and workflow changes with the goal of improving surgical pathology turnaround times. However, workflow improvements are limited by insufficient technical support.

D. Quality and Relevance of Clinical Services Provided to Patients

A large number of mechanisms are in place to monitor the quality and relevance of clinical services provided by our department. It has been estimated that approximately 70% of the diagnosis are made/confirmed by laboratory test. These tests are key to assessing prognosis and selection of targeted therapy. All laboratories undergo IQMH review on a regular basis and our laboratories are ISO 15189 plus certified. Since 2016, we have undergone quarterly performance reviews (rather than annual), which provide us with data in a more timely way. All of our reviews and IQMH survey reports are available upon request.

Overall our approach to quality management is outlines in Figure 6. We will further outline some of our processes in a program specific way.

Figure 6 : Diagrammatic Representation of our Quality Management System



Program of Pathology

This program includes surgical pathology, cytology, autopsy services, microbiology and molecular diagnostics. Outlined below is an overview of the quality and relevance of clinical services provided to patients in these areas.

1. Turnaround Times (TAT)
    - Turnaround time for all our cases (i.e. surgical pathology, cytology, autopsy) are monitored. We acquire turnaround time data in a task specific manner (e.g. specimen accession, transport, pre-analytical, analytical etc). Hence, we can address TAT issues very specifically.
2. Rush Cases
    - Clinicians can request their cases to be expedited by calling the Pathology front office. These cases will be fast tracked and the clinicians called with a diagnosis ASAP.
3. Specimen Volumes
    - Steady increase in surgical pathology specimen volumes and autopsy numbers highlights importance of Pathology to clinical decision making.
    - In the cytology division, our cytotechnologists continue to provide the efficient and highly valued Rapid Onsite Evaluation (ROSE) FNA service in 3 locations (1,094 cases last year) and this volume is steadily increasing. There is also an increase in number of cytology samples from advanced imaging techniques such as Endoscopic Ultrasound (EUS) and Endobronchial Ultrasound (EBUS) guided FNAB procedures.
4. Cancer Care Ontario Data
    - Implementation of mtuitive improved the completion rate for synoptic reports significantly.
    - Low improvement in TAT due to increased volume and technical staff levels.
5. Clinical Rounds
    - Pathologists attend many multidisciplinary cancer conferences and participate in clinical, working and educational rounds. These events serve as additional quality improvement tools. Pathologist input is critical for decision making on patient treatment and prognosis.
    - Bimonthly "Endoscopic Ultrasound Guided FNAB Rounds" are collaborative cytology rounds developed with gastroenterologists to initiate continuing quality improvement and clinical research projects in this area.
6. Physician Initiated Review
    - A request by a clinician for an internal review of a completed pathology case is handled in a uniform manner. This includes documentation of the request, communication with the original pathologist and documentation of the results of the review. After reviewing the case, opinion is documented in Physician Initiated Review Form. This opinion is shared with a second pathologist and their comments are documented. The clinician is notified verbally or by e-mail. In some cases, a supplemental or corrected report may be necessary.
7. Intraoperative Consultation
    - Pathologists are available at all three (3) sites for intraoperative consultations. In 2019, we performed 1,181 intraoperative consultations. These are critical for surgeons to make decisions while operating.

8. Call Schedule
    - Pathologists are on call 24/7 for intraoperative consultation as well as for urgent renal and liver biopsies. A call schedule is posted in the department. Relevant departments (e.g. surgery) and switchboard are regularly updated on call schedules and changes thereto.
9. Internal Consultations
    - Pathologists are encouraged to do internal consultation. All such consultations are monitored using internal consultation forms.
10. External Consultations
    - Pathologists provide a large number of external consultation services. They also interpret esoteric testing that are not available in the smaller community hospitals (e.g. ER/PR, Her2 RAS mutation etc.)
11. Intra Departmental Rounds:
    - A large number of intradepartmental rounds are in place. Data from these rounds are also collected. These serve both educational as well as patient care purposes.
12. Clinical Service Consultations with Pathologists
13. Autopsy
    - Autopsy turnaround times are closely monitored. All coroners' autopsies are presented at the weekly rounds in which pathologists, residents and regional coroners participate. All reports are reviewed by the autopsy medical leader or his/her delegate. We have initiated a quality improvement process for hospital autopsies. We are sending all hospital autopsies provisional anatomic diagnosis reports to Chair of Medical Advisory Committee for his review and discussion with the relevant department and feedback.
    - Several data are collected from the autopsy service. These are for hospital as well as for coroners' autopsies.
14. Cytology
    - The cytology division continues to be efficient in providing test results with TATs in lab target. The division has a robust ongoing technical and professional quality management program in place and a variety of ongoing Gyn and Non-Gyn QA procedures are implemented in this division. These are in line with the recently developed provincial Standards 2 Quality Management Guidelines for Cytopathology (2013)
15. Immunopathology
    - A robust QI process is in place in the immunopathology laboratory. We use an automated IHC platform with standardized operating procedures. Multi-tissue controls are prepared from normal and tumour tissues processed in the same way as specimens are processed. Furthermore, all IHC slides are reviewed by the Director of Immunohistochemistry for quality prior to delivering the slides to the ordering pathologist.
    - External quality assessments are undertaken: IQMH (mandatory, 4/per year) and cIQc (voluntary, 5-6/year). Results of these assessments are reviewed at the PIQM meeting and at IHC staff meetings.
16. The Professional Interpretation Quality Management Committee (PIQM) monitors clinical quality and supports continuous quality improvement. PIQM exists to provide oversight with regards to quality assurance and quality improvement in professional interpretation.

Division of Molecular Diagnostics

The Molecular Diagnostics Division is comprised of Clinical Biochemical Genetics, Cytogenetics and Molecular Genetics Sections.

Biochemical Genetics is the study of inherited metabolic disorders at the level of proteins, small molecules and genes. Cytogenetics is the study of inherited and acquired diseases in relation to the structure and function of chromosomes, genomic copy number variants and genes. Molecular Genetics is the study of inherited and acquired diseases by the identification and tracking of associated DNA and RNA (nucleotide) alterations in genes. Testing is performed on prenatal, perinatal, postnatal samples from patients with inherited diseases as well as on samples from patients with cancers such as leukemia and lymphoma. Genomic microarray testing is performed on individuals with developmental delay and/or multiple congenital anomalies. Laboratory results are used by clinicians from many disciplines (oncologists, pathologists, paediatricians, geneticists, neurologists, hematologists) and tests results are used in the diagnosis, prognosis and/or directing treatment and monitoring of patients.

The laboratory sections within the Division of Molecular Diagnostics are accredited by the province. Tests are licensed through the Ontario Ministry of Health. Proficiency testing is performed through external quality assurance programs [such as Institute Quality Management Health Care (formerly QMPLS), College of American Pathologists, European Program ERNDIMQA}.

Turnaround times are monitored regularly and for certain tests are reported quarterly to agencies such as the Ministry of Health and Long Term Care (MOHLTC) and Cancer Care Ontario (CCO).The laboratories follow the Canadian College of Medical Geneticist (and as appropriate, the American College of Medical Genetics and Genomics) recommendations for test turnaround times (TATs). Professional and technical staff participate in accredited continuing medical education programs. The laboratories have met requirements to perform additional gene testing for recent expressions of interest for repatriating genetic tests through MOHTLC and for performing personalized genetic tests through CCO.

Division of Microbiology

The Division of Microbiology has undergone a tremendous transformation during the past 5 years and is now staffed by 2.5 Medical Microbiologists and 2 Clinical Microbiologists as well as a new Coordinator and a full complement of technical staff. The microbiology group oversees not only all microbiology for the London hospitals but also the microbiology services for Strathroy, Woodstock, Ingersoll, Tilsonburg, St. Thomas and Chatham-Kent. This regional service allows for a common platform of quality microbiology testing as well as access to dedicated microbiology professionals for London and surrounding hospitals. Due to increasing volumes the lab is preparing for the next transformation project to implement Total Lab Automation.

The incredible response of the microbiology lab to implement COVID-19 testing within a matter of days is a testament to the ability of this lab to manage change. Infection Control at LHSC is overseen by the microbiologists and the response to the recent pandemic while appropriate has revealed that further professional resources are needed.

Program of Laboratory Medicine

Similarly, a number of mechanisms are in place to monitor quality and relevance of clinical services provided by the Program of Laboratory Medicine. This program includes hematology, biochemistry, core laboratory/point of care testing, transplant immunology and pulmonary function laboratories. These laboratories are key players to delivery of patient care.

Outlined below is an overview of the quality and relevance of clinical services provided to patients in these areas.

- Laboratory Medicine uses various inputs from the Quality Committee, Safety Committee and all of our key performance metrics and audits to set resourcing and prioritization of improvement projects.
- Most improvement initiatives are led by our Quality and Process Improvement Specialist; others are section specific improvements led by lab leaders.
- Where possible on-going metrics are reported to support completed projects for a set time period. For some completed projects we are providing on-going data support for improvement to patient care processes.

E. Overview of How Clinical Quality is Measured

All laboratories undergo IQMH review on a regular basis. Furthermore, our laboratories are ISO 15189 plus certified.

All abnormal cases are reviewed daily in the microbiology laboratories. Our clinical chemists take part in signing out and review of specialty chemistry laboratories on a daily basis.

Some of the regular collected data include:

- Turnaround Time Reports
- Staff Competency
- Lab Test Centre Satisfaction and Turnaround Time Audits
- Specimen Receiving Collection to Receipt Audits
- Blood Transfusion Product Audits
- Corporate Quality Audit
    - Cancelled Orders Audit
    - Hemolysis Audit
- Ischemic Time Audits

The Safety Committee comprised of MLT volunteers and lab leadership meets monthly to discuss:

- Audits
- Nonconformance follow-up
- IQMH requirements
- Joint occupational health audits safety improvement initiatives

Our auditing cycle is set at 6 months, and 28 labs are audited for approximately 76 requirements. Every month, 4 lab audits are reported to the Safety Committee who decide on non-conformance severity and who address non-conformity follow-up. All Pathology and Laboratory Medicine staff have access to the Safety Committee Dashboard located on a shared network drive.

All relevant issues identified at the LT or SLT levels are brought to the attention of the relevant groups and vice versa.

Choosing Wisely

One the primary goals in the PALM startegic plan is to of improve laboratory utilization for both core laboratory and specialty testing. Under the leadership of Dr. Ian Chin-Yee, Program Head of Laboratory Medicine since 2016, PALM has undertaken more than 24 projects aimed at improving utilization across all laboratories including, microbiology, molecular diagnostics, core laboratoies, hematology, and biochemisty. Many of these projects part of the Choosing Wisely Canada (CWC) campaign to reduce overuse in hospitals and other projects are local initivatives aimed improving utilization and reducing redundant or repetitive testing.

Highlights from Choosing Wisely inlcude reducing daily "routine" blood testing on general medicine wards, eliminating or reducing testing for folate, Viatmin D, ESR, Fecal occult Blood Testing, Ova and parasites. Many of the intiaitves are novel such as rationalizing cytogenetic testing in the era of Next Generation Sequencing and highlight our leadership and leading-edge work in both quality and process improvement to more effectively manage laboratory resources. These efforts have lead to a number publications in peer reviewed journals and renewed enthusiasm among frontline staff aiming to make impact on helathcare delivery. It is estimated over time these efforts will lead to cost avoidance of close to $1 Millon annually.

The leadership of PaLM in improving utilization has catalzyed other areas within LHSC and the region to undertake similar Choosing Wisely Canda campaigns under our mentorship. The process has engaged mutiple stakeholders across many departments including nursing, pharmacy and medical staff who are now actively enaging in their own quality improvement initaitives, often with support and mentorship of our laboratory teams.

LHSC was recently recognized for being 1 of only 3 hospitals in Ontario to attain the designation of a ***Level 3 Choosing Wisely Canada Hospital*** for the number of project undertaken and the leadership role we have played provinically and nationally.

3. Department Overview

3.1 Faculty and Staff

A. Faculty Complement at a Glance (as of April 1, 2020)

As of April 1:	2005	2010	2015	2020
AP: Anatomical Pathologists	19	25	26	28
CMB: Clinical/Medical Biochemists	0	0	6	7
CMG: Cytogeneticists/Molecular Geneticists	1	1	4	4.5
MM: Medical Microbiologists	0	3	3.5	4.5
NP: Neuropathologists	4	3	3	3
OP: Oral Pathologists	2	2	2	2
PhD: Basic Scientists	3	5	6	14
TI: Transplant Immunologist	1	1	1	1
Hematologists	3	3	3	2
Total FT Appointees	**33**	**43**	**54.5**	**66**
Adjunct Appointees	10	20	32	35
Cross Appointees	10	16	16	17
Total Adjunct and Cross Appointees	**20**	**36**	**48**	**52**
Grant Total	**53**	**79**	**102.5**	**118**

B. Faculty

Anatomical Pathologists (28)

Name	Date of Appointment	Academic Rank
Armstrong, Chris	2000/08/01	Associate Professor
Chakrabarti, Subrata	1994/07/01	Professor
Chan, Nancy	2007/01/01	Associate Professor
Driman, David	1994/07/01	Professor
Ettler, Helen	1996/07/01	Associate Professor
Gabril, Manal	2007/04/01	Associate Professor
Garcia, Bertha (0.5)	1985/07/01	Professor
Goebel, Emily	2020/01/01	Assistant Professor
Gomez Lemus, Jose	2006/12/01	Associate Professor
Haig, Aaron	2010/01/01	Associate Professor
Howlett, Chris	2010/01/01	Associate Professor
Jackques, Rebekah	2019/01/14	Assistant Professor
Joseph, Mariamma	1986/08/01	Professor
Kwan, Keith	2001/09/01	Associate Professor

McLachlin, C. Meg	1994/09/01	Professor
Moussa, Madeleine	1991/09/01	Professor
Parfitt, Jeremy	2008/07/01	Associate Professor
Rizkalla, Kamilia	1989/07/01	Professor
Sangle, Nikhil	2013/08/19	Assistant Professor
Shepherd, Jessica	2000/06/01	Associate Professor
Shkrum, Mike	1986/10/01	Professor
Tuck, Alan (0.5)	1996/07/01	Professor Emeritus
Tugaleva, Elena	2008/07/01	Associate Professor
Tweedie, E.(Ted)	1997/08/01	Associate Professor
Walsh, Joanna	2012/08/22	Associate Professor
Wehrli, Bret	2001/09/01	Associate Professor
Weir, Michele	2001/09/01	Professor
Zeman-Pocrnich, Cady	2017/10/16	Assistant Professor
Zhang, Qi (0.5)	2017/11/01	Assistant Professor
Zhao, Liena	2018/09/01	Assistant Professor

Clinical/Medical Biochemists (7)

Name	Date of Appointment	Academic Rank
Bhayana, Vipin	1998/07/01	Associate Professor
Knauer, Michael	2018/03/01	Assistant Professor
Rip, Jack	1989/01/01	Assistant Professor
Rupar, Charles (Tony)	2001/11/01	Professor
Rutledge, Angela	2014/07/01	Assistant Professor
Stevic, Ivan	2019/07/01	Assistant Professor
Yang, Liju	2008/01/01	Assistant Professor

Cytogeneticists/Molecular Geneticists (4.5)

Name	Date of Appointment	Academic Rank
Knoll, Joan (0.5)	2007/10/01	Professor
Lin, Hanxin	2015/09/01	Assistant Professor
Sadikovic, Bekim	2014/09/15	Associate Professor
Schenkel, Leila	2020/04/01	Assistant Professor
Yang, Ping	2013/11/04	Assistant Professor

Medical Microbiologists (4.5)

Name	Date of Appointment	Academic Rank
Cabrera, Ana	2018/09/14	Assistant Professor
Delport, Johan	2012/04/01	Assistant Professor
Elsayed, Sameer (0.5)	2009/07/01	Associate Professor
Fuller, Jeffrey	2016/04/18	Associate Professor
Payne, Michael	2018/06/11	Assistant Professor

Neuropathologists (3)

Name	Date of Appointment	Academic Rank
Ang, L.C.	2000/12/01	Professor
Hammond, Robert	1995/07/01	Professor
Ramsay, David (0.5)	1990/07/01	Professor
Zhang, Qi (0.5)	2017/11/01	Assistant Professor

Oral Pathologists (2)

Name	Date of Appointment	Academic Rank
Darling, Mark	2003/04/03	Professor
McCord, Christina	2015/07/01	Assistant Professor

Ph.D. Basic Scientists (14)

Name	Date of Appointment	Academic Rank
Cameron, Lisa	2014/04/01	Associate Professor
Dick, Fred	2019/07/01	Professor
Duennwald, Martin	2012/09/01	Associate Professor
Frisbee, Stephanie	2016/07/01	Assistant Professor
Gibson, Candace	1982/07/01	Professor
Khan, Zia	2007/01/01	Associate Professor
Kiser, Patti	2017/09/01	Assistant Professor
Knoll, Joan	2007/10/01	Professor
McKinley, Gerald	2015/08/01	Assistant Professor
Olea-Popelka, Francisco	2019/01/02	Associate Professor
Poon, Art	2016/08/01	Associate Professor
Shooshtari, Parisa	2019/07/01	Assistant Professor
Smith, Norman	1976/12/06	Associate Professor
Wylie, Lloy	2013/09/01	Assistant Professor

Transplant Immunologist (1)

Name	Date of Appointment	Academic Rank
Sidhamed, Abubaker	2020/02/01	Assistant Professor

Hematologist (2)

Name	Date of Appointment	Academic Rank
Chin-Yee, Ian	2016/07/01	Professor
Solh, Ziad	2017/10/16	Assistant Professor

Adjunct Professors (35)

Name	Date of Appointment	Academic Rank
Ainsworth, Peter	1990/10/15	Adjunct Clinical Professor
Allevato, Pat	2008/07/01	Adjunct Clinical Professor

Arany, Edith	2008/07/01	Adjunct Research Professor
Back, Jason	2017/10/01	Adjunct Clinical Professor
Banks, Kate	2019/09/16	Adjunct Research Professor
Bend, Jack	2013/07/01	Adjunct Research Professor
Blandino, Ivan Pacheco	2014/10/01	Adjunct Clinical Professor
Charyk Stewart, Tanya	2008/01/01	Adjunct Assistant Professor
D'Agostino, Michael	2015/01/01	Adjunct Clinical Professor
Deliallisi, Ardit	2014/07/01	Adjunct Clinical Professor
Divaris, Dimitrios	2015/01/01	Adjunct Clinical Professor
Elkeilani, Akram	2017/09/01	Adjunct Clinical Professor
Feng, Biao	2008/01/01	Adjunct Research Professor
Garcia-Marquez, David	2018/06/01	Adjunct Clinical Professor
Gidwani, Ram	1990/07/01	Adjunct Clinical Professor
Iakovleva, Gaiane	2016/04/01	Adjunct Clinical Professor
Kadour, Mike	2018/02/01	Adjunct Assistant Professor
Kandel, Rita	2015/01/01	Adjunct Clinical Professor
Katsivo, Melanie	2013/09/01	Adjunct Research Professor
Lubynski, Rosemary	2000/07/01	Adjunct Clinical Professor
Mann, Rick	2018/10/01	Adjunct Research Professor
Nasim, Khalida	2014/10/01	Adjunct Research Professor
Newell, Ken	2019/02/01	Adjunct Clinical Professor
Pickup, Michael	2014/09/01	Adjunct Clinical Professor
Price, Russell	2015/01/01	Adjunct Clinical Professor
Raphael, Simon	2015/01/01	Adjunct Clinical Professor
Rouse, Tyler	2015/09/01	Adjunct Clinical Professor
Sayegh, Daad	2015/10/01	Adjunct Professor
Shukoor, Sajid	2008/11/01	Adjunct Clinical Professor
Shum, David	2001/07/01	Adjunct Clinical Professor
Smith, Pamela	2012/01/01	Adjunct Clinical Professor
Somers, Gino	2015/01/01	Adjunct Clinical Professor
Tadross, Latif	2015/01/01	Adjunct Clinical Professor
VanDeven, Teresa	2013/09/01	Adjunct Research Professor
Wasty, Fasahat	2015/01/01	Adjunct Clinical Professor

Cross-Appointees (17)

Name	Appointment	Home Department	Academic Rank
Bhattacharjee, R.	2019/05/01	Surgery	Assistant Professor
Dhanvantari, Savita	2003/07/01	Medical Biophysics	Assistant Professor
Dong, Cecilia	2019/08/01	Dentistry	Assistant Professor
Elsayed, Sameer	2012/07/01	Medicine	Associate Professor
Filler, Guido	2006/09/01	Pediatrics	Professor
Hutnik, Cindy	2005/01/01	Ophthalmology	Professor
Izawa, Jonathan	2012/11/01	Surgery	Associate Professor
Joy, Tisha	2006/07/01	Medicine	Associate Professor
Koropatnick, D. Jim	1988/07/01	Oncology	Professor
Maleki, Saman	2018/03/01	Oncology	Assistant Professor
Min, Weiping	2004/07/01	Surgery	Associate Professor

Peng, Tianqing	2007/01/01	Medicine	Professor
Rui, Tao	2014/01/01	Medicine	Assistant Professor
Strong, Michael	1993/07/01	CNS	Professor
Thang, Trevor	2019/09/01	Dentistry	Assistant Professor
Zhang, Zhu-Xu	2007/04/01	Medicine	Associate Professor
Zheng, Xiufen	2009/07/01	Surgery	Associate Professor

C. Administrative/Technical Staff (Western)

Manager, Administration and Finance	Angela DeCandido
Finance Assistant	Nan Meng
Education Coordinator, Undergraduate & Postgraduate Programs	Cheryl Campbell
Education Coordinator, Graduate Programs	Tracey Koning
Media Specialist	Kathilyn Allewell
Departmental Technician	Linda Jackson-Boeters
Administrative Assistant (Part-Time)	Susan Underhill

D. Administrative/Laboratory Staff (Hospitals)

Director, Pathology and Laboratory Medicine	Dr. M. Kadour
Manager, Pathology	Sue Milburn
Manager, Laboratory Medicine	Rick Bak
Manager, Regional Partnerships and Business Development	Jennefer Masters
Manager, Quality	Manuella Giuliano
Business Manager	Caterina Mancusi
Administrative Assistant: Chair/Chief	Lisa Walker
Administrative Assistant: Director	Fran Richards

Coordinator (13)
Senior Technologist (26)
Pathology Client Support Representatives (3)
Pathology Secretaries (11)
Laboratory Client Support Representatives (6)
Laboratory Secretaries (6)

Medical Laboratory Technologists:

	2011	2014	2019
Number of FTEs-FT	361	353	403
Number of FTEs-PT/Casual	36	43	31
Number of FTEs-Temp	11	8	7
Total Number of FTEs	**408**	**403**	**441**

E. Post-Doctoral Scholars

Name	Supervisor	Appointment Type
Champredon, David	Dr. Art Poon	Post-Doctoral Associate
Esmaeili, Mohammad	Dr. Martin Duennwald	Post-Doctoral Associate
Ferreira, Roux-Cil	Dr. Art Poon	Post-Doctoral Associate
Haghshenas, Sadegheh	Dr. Bekim Sadikovic	Post-Doctoral Associate
Ling, Feng Jun	Dr. Xiufen Zheng	Post-Doctoral Associate
Ni, Rui	Dr. Tianqing Peng	Post-Doctoral Associate
Olabode, Abayomi	Dr. Art Poon	Post-Doctoral Associate

3.2 Governance and Organizational Charts

The following appendices will provide greater detail on governance and organizational structure.

Appendix 3.2.1: Hospital Governance System
Appendix 3.2.2: Hospital Organizational Chart
Appendix 3.2.3: Academic Organizational Chart

3.3 List of Committees

Academic and Research Committees (Western University)

1. Executive Committee
2. Clinical Appointments & Promotions Committee
3. UWOFA Appointments Committee
4. UWOFA Annual Performance Evaluation (APE) Committee
5. UWOFA Promotion & Tenure Committee
6. UWOFA Workload Committee
7. Continuing Professional Development Committee (CME)
8. Pathology and Laboratory Medicine Education Committee
9. Undergraduate Education Committee
10. Graduate Education Committee - Research
11. Masters of Clinical Science: Pathologists' Assistant Graduate Education Committee
12. Masters of Clinical Science: Pathologists' Assistant Selection Committee
13. Research Committee
14. Anatomical Pathology Residency Program Committee
15. Clinical Competence Committee
16. Neuropathology Residency Program Committee
17. AFC Diploma Program in Cytopathology Committee
18. Fellowship Committee
19. Safety Committee
20. Pathology Financial Management Committee

Clinical Committees

1. Pathology and Laboratory Medicine-Senior Leadership Team
2. Pathology and Laboratory Medicine-Leadership Team
3. Quality Assurance
4. Tissue and Archive Committee
5. Ontario Institute for Cancer Research
6. Professional Interpretation Quality Management Committee
7. Clinical Biochemistry Team
8. Point of Care Testing Committee
9. Microbiology Divisional Team
10. Transplant Stakeholders Committee

For the Committees listed above, Terms of Reference and Membership are available upon request.

Our Governance System: Decision-authorities, Meetings and Organization Structure

Pathology and Laboratory Medicine

Effective: November 2016
Revised: April 10, 2019

The primary objective of the governance system is to assist us in controlling and improving performance

Performance dimensions with sample key indicators

Quality, Clinical & Clients	Financial Stewardship	Operational Efficiency	Learning and Growth
• Test performance • Clinical utility • TAT / Access • Appropriate use • Client survey	• Cost-per-test • Budget variance • Revenue / Funded volume growth • Predictable / stable costs	• Labour productivity • Unplanned downtime • Reagent / Equip utilization • OT	• A3s • Staff survey • New test/services • Future leaders • Sick time

Our governance system is designed to reinforce accountability, partnership and involvement

- Our governance system identifies:
  1. how we **make decisions and manage performance**
  2. how we **organize ourselves**, and
  3. our **respective accountabilities** including roles and responsibilities
- There are several key design elements of our governance system:

Continuous Improvement	Everyone Always Knowing How We Are Doing	Leading through Doctor-Manager Partnership
➢ Our management processes from the daily-level to the departmental-level will continue to be **standardized and focused on driving continuous improvement**, both through **incremental and transformative** changes	➢ We see accountability as the ownership of responsibilities combined with the **obligation to report on the discharge of those responsibilities** ➢ To reinforce accountabilities and drive continuous improvement, everyone must always know how we are doing – in an objective and ideally measured way. This is achieve by making available **reliable and timely reports about intended and actual results** presented using visual management techniques ➢ **Regular formal reviews of key performance** information is embedded into all levels of governance ➢ As we continue to develop the skills and capabilities of measurement and reporting we will further enhance the tools used to support the governance system (e.g. KPI/Performance dashboards etc.)	➢ A key design element of our governance system is the **Doctor-Manager partnership** within in a **joint-leadership model** ➢ We bring both sides into a **mutually interdependent relationship**, where the success of each side is in the hands of the other, to create a powerful alignment of interests, strategy and responsibilities. Medical/scientific staff focusing solely on clinical quality and management staff focusing solely on use of resources and productivity are destined for collision. ➢ Our governance meetings (decision-making, performance management) formally include our doctor-manager partnerships to enhance quality and day-to-day operations

At it's basics, the governance system describes how accountabilities are discharged across the department

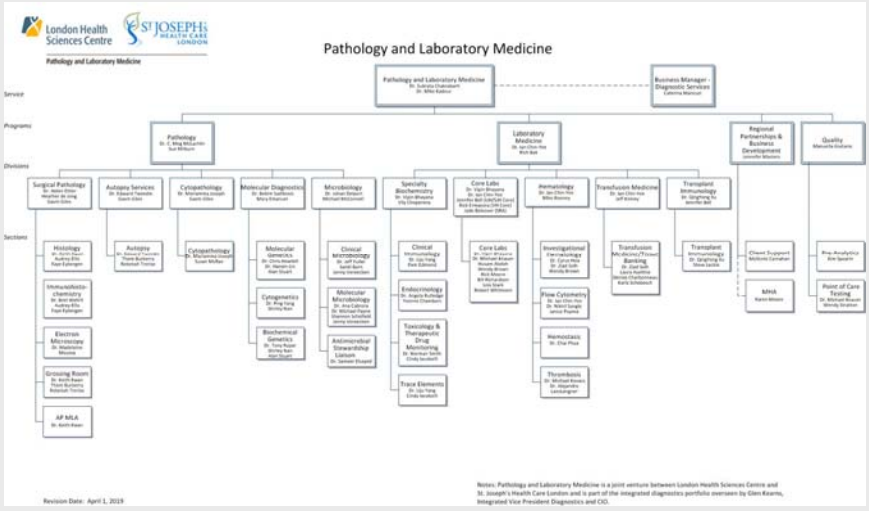
How accountabilities are discharged

- Primary objective is controlling and improving performance
- The Chief & Director (C&D) are ultimately accountable for the performance of the entire department
- C&D use PaLM-Senior Leadership Team (PaLM-SLT) to govern the department, including and especially its performance
- C&D hold the Program Head & Manager (PH&M) accountable for the performance of their program and its divisions through the Quarterly Review process. In a similar manner PH&M hold the Division Head & Coordinator (DH&C) accountable for their scope of overview.
- PaLM-SLT defines Performance Indicators and targets for all Divisions in consultation with DH&C
- PaLM-SLT defines annual Key Performance Indicators associated with strategically important improvements
- PaLM Quality Office manage the Performance Indicators and support the facilitation of the Quarterly Review process
- Once a year, PaLM-SLT reviews the department as a whole in a Annual Management Review, drawing predominantly (but not exclusively) from the findings of the Quarterly Review process

Standardized leadership roles across the department clarifies and simplifies how we operate

Level	Example	Leadership Partners	
		Medical / Scientific role	Management role
Department (Service)	Pathology and Lab Medicine	Chair / Chief	Director
Program	Pathology	Program Head	Manager
Division	Surgical Pathology	Division Head	Coordinator(s)
		Medical/Scientific role	Technical role
Section	Histology	Section Head	Senior Technologist

Our org chart reinforces the doctor- manager partnership and clarifies accountabilities



A performance dashboard is available which cascades/rolls-up for all units within our org chart

Defined decision-authorities guides our collective understanding of who can take what decisions

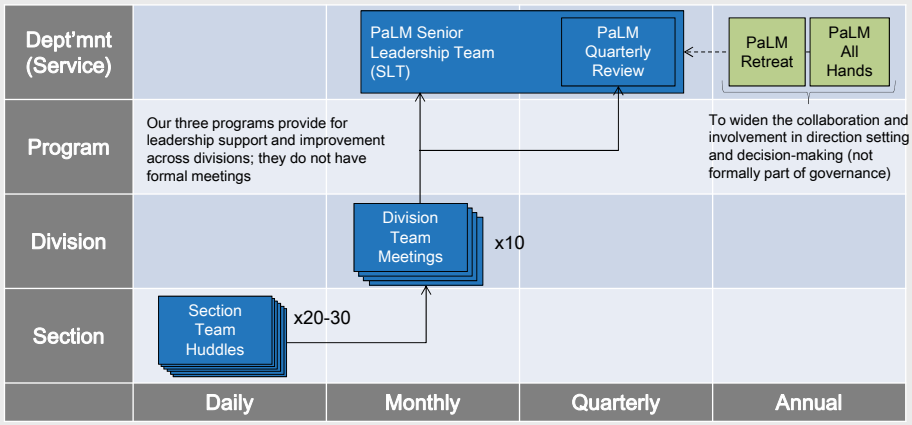
Governance decision-authorities - Who can take what decisions *Not exhaustive*

Decision category	Section Leaders (SH & Senior Ts)	Division Leaders (DH & Coords)	Program Leaders (PH & Mgr)	Service Leaders (CC & Dir)
Quality / Services / Technical	• Technical trouble-shooting • Efficiency / workflow improvements	• Major methodology or process changes • Quality indicators • Ceasing or controlling test access • Taking on funded external work	• Platform/major equipment decisions • Program-wide quality improvement initiatives	• Key performance indicators • Key vendor contracts • Adding tests
Finance	• Consumables purchasing	• Within-budget division funding priorities • Division capital priorities	• Within-budget program funding priorities • Program capital priorities	• Budget strategies • Service capital priorities • Pricing of tests/services
Workforce	• Scheduling / bench assignments • Within-day/shift work patterns	• Shifts patterns, staff mix, replacement, performance management	• Changes in staffing levels • Hours of operation	• Changes in professional staffing levels • Leadership changes
Physical	• Daily flow	• Layout within space	• Sharing space • Relocating within existing footprint	• Moves, major reconfigurations
Strategy	*Contributing to Divisional strategy*	• Division goals, objectives and initiatives	• Aligning division strategies	• PaLM-wide directions • Portfolio investments/ divestments

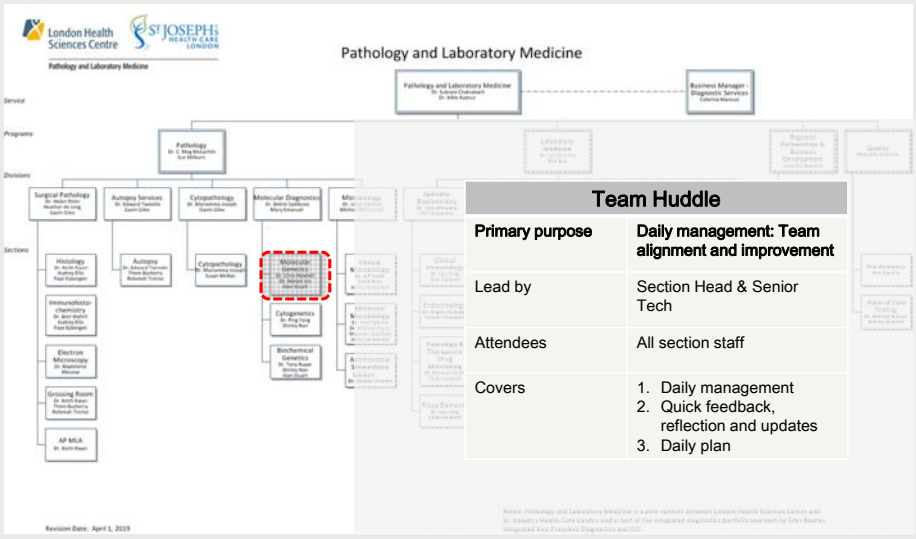
8

Monthly team meetings at all levels, with daily section team huddles, supports robust and timely governance

This series of team meetings constitutes our formal governance line (i.e. decision-making and performance management). They include our doctor/manager leadership partners and others as appropriate. Specific med/sci-only and managerial-only meetings may also be used to pragmatically support the smooth running of the service, but formal accountability and decision-making is through these joint meetings only.

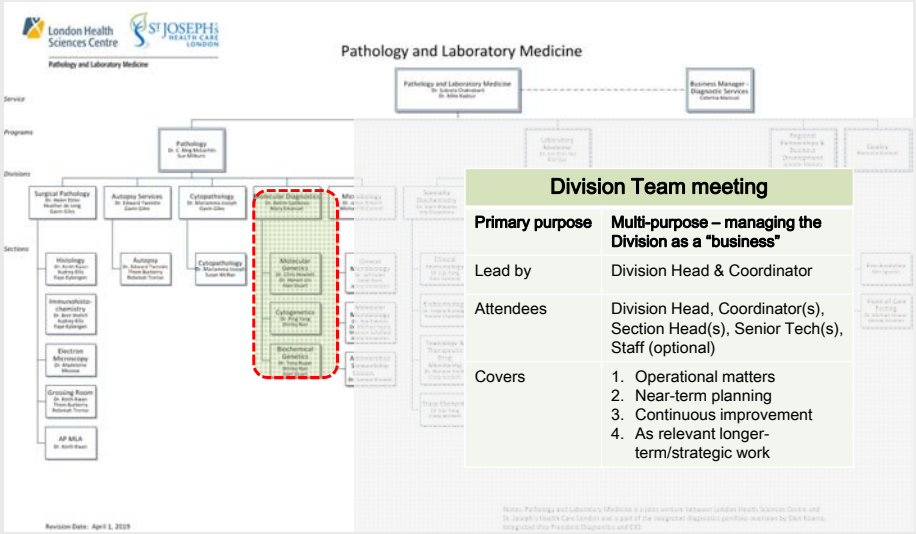


It all starts with a quick team huddle within every section at the beginning of every day or shift



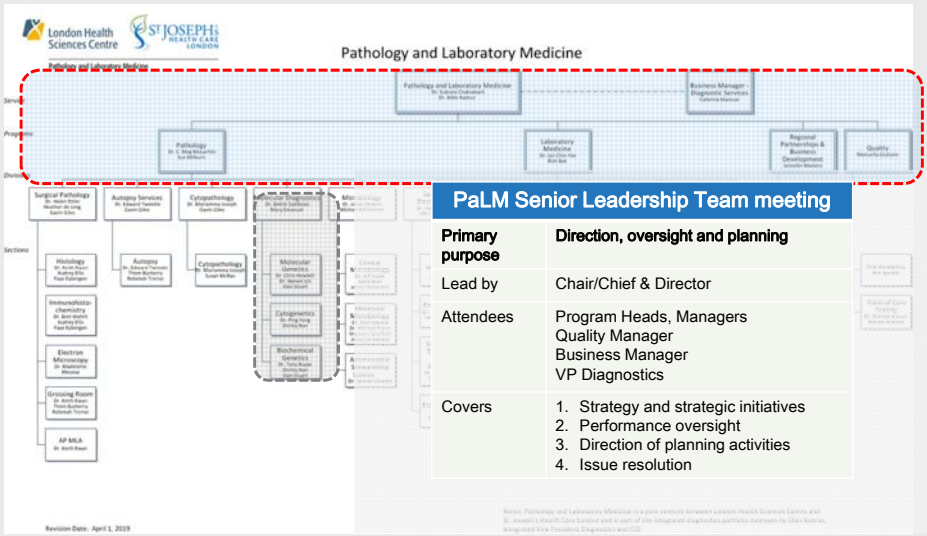
Team Huddle	
Primary purpose	**Daily management: Team alignment and improvement**
Lead by	Section Head & Senior Tech
Attendees	All section staff
Covers	1. Daily management 2. Quick feedback, reflection and updates 3. Daily plan

The monthly Division team meeting is the primary driver for action - leaders and staff cover all local topics



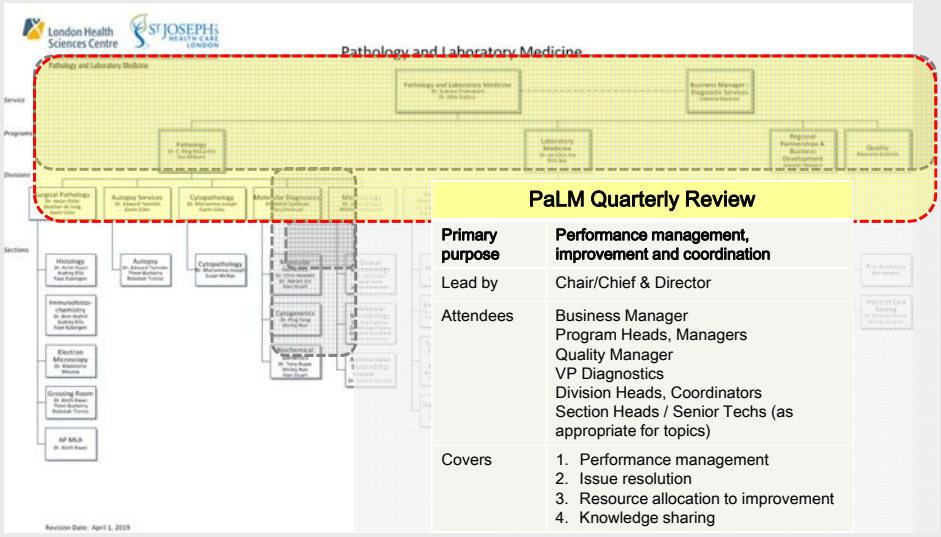
Division Team meeting	
Primary purpose	**Multi-purpose – managing the Division as a "business"**
Lead by	Division Head & Coordinator
Attendees	Division Head, Coordinator(s), Section Head(s), Senior Tech(s), Staff (optional)
Covers	1. Operational matters 2. Near-term planning 3. Continuous improvement 4. As relevant longer-term/strategic work

The PaLM Senior Leadership Team leads service-wide work and strategy, and oversees overall performance



PaLM Senior Leadership Team meeting	
Primary purpose	**Direction, oversight and planning**
Lead by	Chair/Chief & Director
Attendees	Program Heads, Managers Quality Manager Business Manager VP Diagnostics
Covers	1. Strategy and strategic initiatives 2. Performance oversight 3. Direction of planning activities 4. Issue resolution

The PaLM Senior Leadership Team leads service-wide work and strategy, and oversees overall performance



PaLM Quarterly Review	
Primary purpose	**Performance management, improvement and coordination**
Lead by	Chair/Chief & Director
Attendees	Business Manager Program Heads, Managers Quality Manager VP Diagnostics Division Heads, Coordinators Section Heads / Senior Techs (as appropriate for topics)
Covers	1. Performance management 2. Issue resolution 3. Resource allocation to improvement 4. Knowledge sharing

The monthly meeting cycle will be phased such that escalation and oversight can happen within days

Monthly cycle of governance meetings

	Month 1					Month 2
	Week 1	Week 2	Week 3	Week 4	.	Week 1
Division		Finances for past month ready at end of Week 2 – Variance reports prepared; Dashboard updated	**Division Team meeting**: all business including reviewing dashboard			
Department (Service)				**PaLM-SLT**: all business including reviewing dashboard at departmental-level		
				PaLM Quarterly Review: Performance management and continuous Improvement reviewing each Division in-depth		**Corporate Quarterly Reviews**

The full set of governance meetings involves the right leaders at the right time with a specific focus

Scope	Meeting	Freq.	Purpose	Regular Attendees							
				Service Leaders (CC & Dir)	Business Manager	Quality Manager	Program Leaders (PH & Mgr)	Division Leaders (DH & Coords)	Section Leaders (SH & Senior Ts)	Staff	Others
Dept (PaLM)	PaLM-SLT	M	Direction, oversight and planning	✓	✓	✓	✓				VP
Dept (PaLM)	PaLM-Quarterly Review	Q	Performance management, Continuous improvement, Coordination	✓	✓	✓	✓	✓	As required		VP
Division	Division Team meeting	M	Multi-purpose – managing the Division as a "business"				As required	✓	✓	As decided by Division	
Section	Team Huddle	D	Team alignment and improvement						✓	✓	
Service (PaLM)	PaLM All Hands	A	Awareness, alignment, collaborative feedback, building momentum	✓	✓	✓	✓	✓	✓	✓	
Service (PaLM)	PaLM Retreat	A	Deeper reflection on strategy and improvement	✓	✓	✓	✓	✓	✓		VP

Quarterly Review Guiding Principles

- ❑ Each member expected both to challenge performance and contribute towards improvement
- ❑ Contributions are to be constructive while also setting high expectations
- ❑ Nothing should be taken or directed personally – this is about the service and its performance
- ❑ Success should be recognized, appreciated, reflected upon and learned from
- ❑ There are no "dumb questions" – if something seems odd or interesting it should be raised
- ❑ The Quality Office is present and part of the process
- ❑ Timing is managed tightly to respect everyone's schedule and ensure balanced review
- ❑ Chair actively facilitates to ensure the above is met
- ❑ In order to facilitate improvement, PaLM-SLT should:
  - ➢ SET clear objectives: reinforce what is trying to be accomplished
  - ➢ DEFINE evaluation criteria: clarify how we will know changes are improvements,
  - ➢ CHALLENGE the actions being taken for improvement: promote regular evaluation and iterative improvement actions
- ❑ Where specific improvement efforts are required, a **Project Charter** or **A3** should be used by the Division to encourage effective and sustained improvement

Quarterly Review Process

- Division-by-division review
  - Some may be consolidated, some “non-divisions” may be included
  - PaLM-SLT to set review calendar – which divisions in which meetings. Most divisions will be reviewed quarterly, but some may reviewed less frequently if objectives are being met, risk is low and if divisional performance is fully in control.
- Include all Quality Office members – performance data facilitated by Quality Office
- 20 minutes maximum per division (hard stop to keep us moving)
- Performance data is reviewed from the PaLM Dashboard suite:
  - Master (finance, operations, people), TAT, Quality/EQA, Safety dashboards
- Default is for PH&M speak to the Divisional performance, can be delegated to DH&C on discretion of PH&M. A “presentation” may not be requested or required if areas of focus are known. If one is appropriate it should be limited to 25% of the time
- DH&C physically present for questions and discussion. Additional invitees at the discretion of the PH&M (e.g. Senior Tech, other Med/Sci)
- Meeting minutes in 3 categories:
  - **Directions**: specific requests made of the division regarding how improvement should be prioritized; to be reviewed at the subsequent performance meeting. May include the direction to initiate a project via Charter or A3.
  - **Actions**: specific actions of an individual to be included in the PaLM-SLT action table; if in relation to DH&C the PH&M should speak to it at the next PaLM-SLT
  - **Comments**: general observations of record (kept to a minimum)

Tips for the Quarterly Review

- The Management Dashboard (link=> Management Dashboard) will be reviewed as the primary data source accompanying the report. All metrics in the Management Dashboard requiring attention (flagged red or yellow, or worsening) should be referenced in the report.
- At this time the Management Dashboard covers only a limited number of key performance indicators. We are working to expand this. In the interim, the Divisional leaders are ask to report holistically on performance across all four performance dimensions referencing common lab performance expectations (e.g. TAT, EQA/QC, non-conformances, AEMS/safety, eliminating waste/downtime, etc.)
- Other data sources may be brought forward ad-hoc where the Division feels they are required to support the reporting. This is at the discretion of the Division and should not be seen as a must-do.
- Manager & Program Head with Coordinator(s) & Division Head speak to performance and planned improvement.
  - **The template provided should be used to summarize areas of high or improving performance as well as poor or worsening performance. The objective is for the department as a whole to help it's Divisions improve – so prioritize areas of opportunity and/or risk.**
- PaLM-SLT members, including the Quality Office, will review the summary beforehand. When the dashboard(s) are further improved through 2016 they will accompany the summary report. At this time the summary report will stand alone.
- Presentation should be kept to a minimum and should focus not on what’s written, but on the leaders perspectives and challenges. The expectation that the summary has been reviewed by PaLM-SLT members beforehand.
- The entire Quarterly Review meeting is open to all Divisional leaders should others wish to be informed or contribute.

F 18 Q4 – replace this text with division name

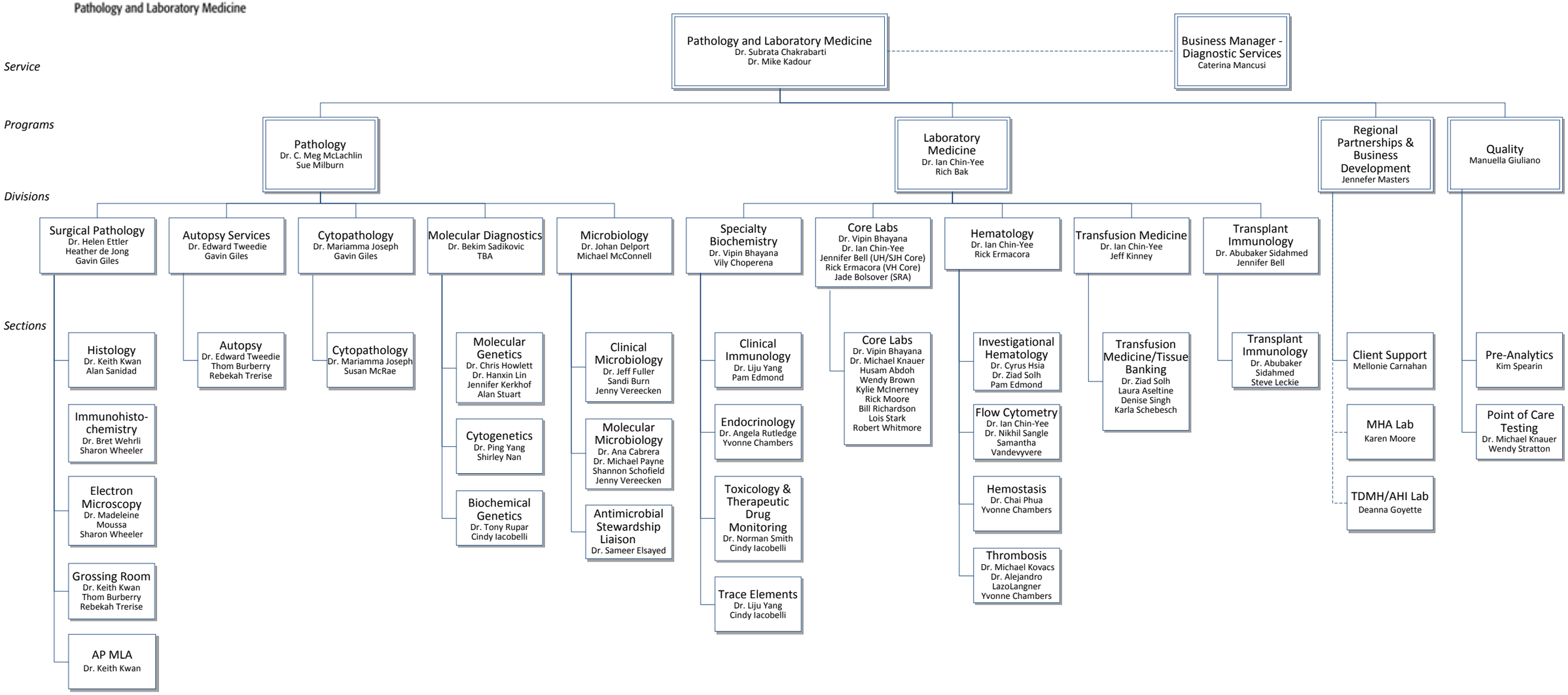
	What does the data mean? *What* is our performance?	*Why* is performance as it is? (Root-causes)	*Now what* will you do? (where necessary) (Improvement plan and expected outcome)
Quality, Clinical & Clients			
Financial Stewardship			
Operational Efficiency			
Learning & Growth			

London Health Sciences Centre

St. JOSEPH's HEALTH CARE LONDON

Pathology and Laboratory Medicine

Pathology and Laboratory Medicine



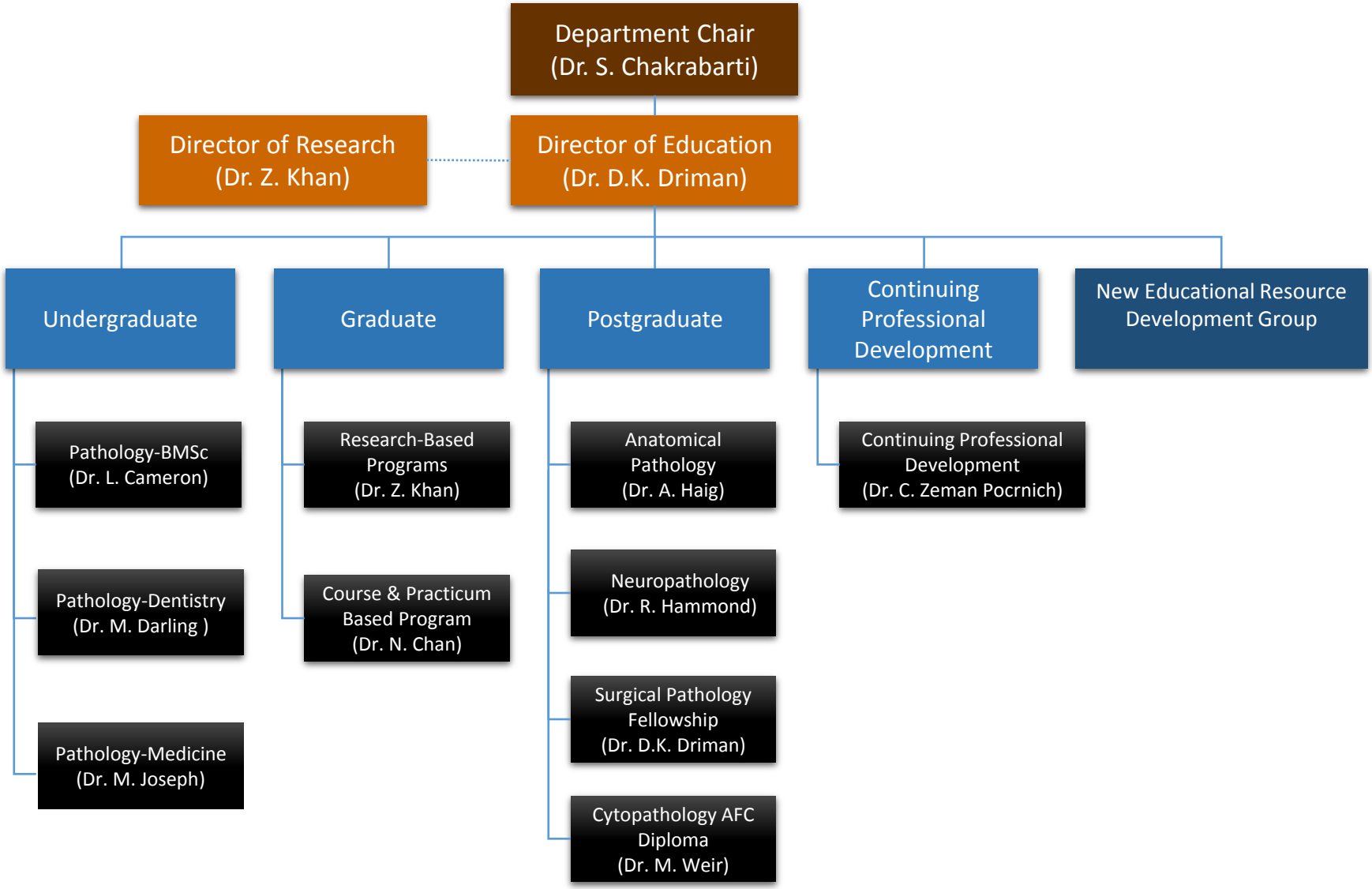
Revision Date: March 23, 2020

Notes: Pathology and Laboratory Medicine is a joint venture between London Health Sciences Centre and St. Joseph's Health Care London and is part of the integrated diagnostics portfolio overseen by Glen Kearns, Integrated Vice President Diagnostics and CIO.

Schulich MEDICINE & DENTISTRY

Department of Pathology and Laboratory Medicine
Academic Department Organizational Chart

Western



Department of Pathology and Laboratory Medicine Education Committee

3.4 Pathology Clinical Service Subspecialty Teams

To develop expertise and increase efficiency, we have formed clinical service sub-specialty teams in anatomical pathology. The members of these teams, in addition to providing clinical service, further develop clinical guidelines and protocols and provide undergraduate and post-graduate education.

3.5 Communications & Culture

Communications

The Department of Pathology and Laboratory Medicine strives to encourage and facilitate open communication within the department. This can be a challenge as our faculty, staff and trainees are dispersed among multiple sites across the city. We maintain a vibrant website and members and departmental committees are actively encouraged to submit news, events, and other stories to the website to keep it current and relevant.

We create and share a monthly departmental newsletter via email, the PaLM Post. The newsletter is archived on our website and is another opportunity to sharer relevant news with our broad group of faculty, staff and trainees.

Until recently, the department also produced an Annual Report, where we would summarize the year's activities in education, research and clinical service. Our Annual Reports are also available on line.

Full departmental meetings are scheduled quarterly. We further have multiple communication methods both in the clinical and academic areas. These include daily huddle, rounding, committee and group meetings as well as yearly 'hands down' meetings.

Team Building

The department supports a variety of events each year where staff, trainees, and faculty can take a break and spend some time socializing. This is a great opportunity for team building. People from all continents make up the Department of Pathology and Laboratory Medicine and it enjoys close to 50:50 gender representation in its faculty, staff and student communities. Our departmental social events are typically a potluck cultural feast of international foods! In an environment such as this there is no place for and zero tolerance toward discrimination or disrespect.

Every year our faculty and staff are nominated for, and win awards – teaching awards, awards of excellence, research awards. Departmental meetings are held quarterly and typically start with a round of congratulations for the accomplishments of department members.

Each year we offer Pathology and Laboratory Medicine branded merchandise, at cost, to the staff, trainees, and faculty. Wearing a branded merchandise instills a sense of pride and identity.

Social Responsibility

The staff and faculty of the Department of Pathology and Laboratory Medicine give of their time

both in the workplace and in the community. Some examples of staff and faculty led initiatives are below:

- Preparing meals for the local Ronald McDonald House and Ark Aid Mission
- Team participation in research-related fundraisers (e.g. cancer, ALS)
- Annual Food Drive Challenge for the London Food Bank
- Toys for Tots (in lieu of traditional, holiday gift exchange)

Wellness

Living Well@Western is Western's premier wellness program, designed to encourage and promote a wide variety of physical, cultural, and intellectual activities. Western staff and faculty are invited to participate in all wellness events, at no cost, including Zumba, yoga, meditation and other fitness programs during the work-week. For example, the administrative team participates in 15-minute stretch breaks every Tuesday and Thursday, led by Adam Craig, Western's Wellness Coordinator. There is also a team member on Schulich's Wellness Committee.

At LHSC, the Where Wellness Works' Fitness Program is available to all personnel free or charge. In additional, wellness instructors lead stretch breaks for the laboratory technicians daily.

Engagement

It is important that as a department, we are aware of the challenges faced by our members. Hence we participated in several surveys, both at LHSC and at Western.

In summary, among the medical and scientific staff the overwhelming majority (87%) were satisfied with their job and 13% remained neutral. Among the technical and support staff, the numbers were 71% and 15% respectively. As expected, one of the challenging aspect identified in this survey, was work/life balance. Full hospital survey results from 2019 are available on our website.

A similar survey was carried out by Western in 2017. For Pathology and Laboratory Medicine, the response rate for staff was 70.6% and the areas of strengths identified in the survey included: role clarity, collaboration with other work units, change management, and satisfaction with leadership. The response rate by faculty to this same survey was lower (35.9%) noting the strengths mirrored those identified by staff. Full Western survey results are available on our website.

Western's "We Speak" engagement survey was conducted again in January/February 2020. Results are expected in June/July 2020.

4. Vision, Mission, Values and Strategic Plans

The Department of Pathology and Laboratory Medicine developed a combined Strategic Plan for the first time in 2018. The plan is closely aligned with the strategic directions set forth by Western University, the Schulich School of Medicine & Dentistry, and London Health Sciences Centre.

Departmental Strategic Plan **(Figure 1)**
Western University's Strategic Plan
Schulich School of Medicine & Dentistry's Strategic Plan
London Health Sciences Centre Strategic Plan

Implementation of the Strategic Plan

Implementation of the plan included the creation of five working groups in the areas of:

- Teaching acumen
- Utilization management
- Research themes
- People development
- Pathology transformation

Mike Kadour (Director, Pathology and Laboratory, London Health Sciences Centre) and Angela DeCandido (Manager, Administration & Finance, Western University) have been meeting monthly since Angela's appointment in October 2019, to discuss implementation of the plan. For 2020-21, the refinement of research themes "where PaLM can excel" will be the primary goal. To this end, they have engaged Dr. Zia Khan, Director of Research and the Research Committee in this process. We are anticipating a progress report in the Fall.

Following this self-study, it is also our intention to map the achievements describe in this self-study, to our plan to inventory where progress has been made and to identify areas of future focus.

Figure 1: Departmental Strategic Plan (2018-2023)

5. Undergraduate Education

The Department of Pathology and Laboratory Medicine has had a long-standing commitment to teaching at the undergraduate level within the faculties of Medicine and Dentistry, Science, Health Sciences, and at Fanshawe College. The Department of Pathology and Laboratory Medicine offers undergraduate pathology courses and training to medical, dental, and nursing students, and many undergraduate courses in Pathology and One Health, open to students in the BMSc/BSc programs.

5.1 Bachelor of Medical Sciences Program

The Department of Pathology and Laboratory Medicine offers several modules in the Bachelor of Medical Sciences (BMSc) Program. These include an Honours Specialization in Pathology, a Major in Pathology, and an Honours Specialization module jointly offered with Western's Department of Computer Science (Medical Health Informatics). Pathology modules in the BMSc program remain one of the most sought-after modules. Interest in our courses and BMSc programs, particularly the Honours Specialization in Pathology, remains high.

Key Highlights Since Self-Study in 2015:

- ☑ Developed Honours Specialization modules jointly with the Department of Biochemistry (Biochemistry and Pathology of Human Disease), and the Department of Microbiology and Immunology (Microbiology and Immunology with Pathology)
- ☑ Developed the first undergraduate Honours Specialization Module in One Health
- ☑ Developed new undergraduate courses in Pathology and One Health to enrich the training of BMSc students
- ☑ Successful completion of Institutional Quality Assurance Process (IQAP) review of the Pathology BMSc modules in 2017.

Program Description and Objectives

The Department of Pathology and Laboratory Medicine at Western University introduced an Honours Specialization and a Specialization module in Toxicology & Pathology, conjointly with the Department of Physiology and Pharmacology in 2005. In the following year, full administration of the program was transferred to the Department of Pathology and Laboratory Medicine. In 2016, the module was renamed Honours Specialization Program (HSP) in Pathology as more courses were developed within our department. Since 2015, we have expanded our module offerings (**Table 5.1**).

Table 5.1: Modules Offered by Pathology and Laboratory Medicine

Module	Launch year
Pathology and Toxicology HSP	2005 (renamed 2015)
Pathology Major	2013
Medical Health Informatics HSP	2014
Biochemistry and Pathology of Human Disease HSP	2014
Microbiology and Immunology with Pathology HSP	2015
Pathology HSP	2015
One Health HSP	2018

Program Development and Growth

Since 2015, we have recruited a number of basic scientists, namely: Drs. Art Poon (bioinformatics, 2016), Stephanie Frisbee (societal factors influencing cardiovascular disease, 2016), Francisco Olea-Popelka (Beryl Ivey Chair in One Health, 2018) and Parisa Shooshtari (bioinformatics, 2019). Dr. Fred Dick moved from Biochemistry to join Pathology and Laboratory Medicine in 2019. On the clinical/service side we also recruited: Drs. Christina McCord (oral pathology, 2015), Qi Zhang (neuropathology, 2017), and Patti Kiser (veterinary pathologist, 2017). These new colleagues have contributed to existing courses, added to new curricular offerings and increased the number of potential supervisors for research projects and therefore enrollment into our modules.

We work hard every year to promote our program at the various campus wide events such as Fall Preview Day, March Break Open House and Intent-to-Register (ITR) events, with substantial faculty involvement. These efforts help to retain interest in our program and to increase the number of research projects available to 4th year students in Honours Specialization modules. This is achieved by establishing collaborations within our department and with researchers in other departments. By increasing the number of research projects, we have been able to maintain and grow enrollment in the Honours modules from 11 in 2015-2016 to 23 in 2019-2020. This steady increase was made possible, in part by developing the new module in One Health (below).

We have recently developed combined Honours Specialization modules with other Departments, such as the Department of Biochemistry - *"Biochemistry and Pathology of Human Disease"*. This module was approved and has been fully active since 2014/15 academic year. We typically take 6-8 students in this module/year. Students take courses offered by either Pathology and Laboratory Medicine or Biochemistry and are able to choose a 4th year research project in either Biochemistry (4483E) or Pathology (4980E). In 2015/2016, we developed a combined Honours Specialization module in *"Microbiology and Immunology and Pathology"*. The students in this module carry out their undergraduate thesis in either Microbiology and Immunology or Pathology. Approximately 6 students are admitted to this program per year. The Honours Specialization Program in *"Medical Health Informatics"* offered with the Department of Computer Science is continually evolving to increase its accessibility to undergraduate and graduate students in Health Information Science. In 2019, a newly developed bioinformatics course (MNI 4750F/G) offered by one of our new basic scientists (Dr. A. Poon) was included as an option for students in this module.

We continue to respond to the needs of our students and evolve our program offerings. Due to great interest in Pathology and our efforts to align our program with that of other Departments, in 2017/2018, we merged our two half-credit third year Pathology courses to a one credit full year course (Pathology 3500). This course is now an important requirement for entry to the modules of our department and ensures students have a strong foundational background and understanding of general and systemic pathology education in Pathology, just as other modules require a full credit in Physiology and/or Pharmacology. In 2018/2019 we also added MNI 2500A/B to the pick list for the Pathology module.

We have also developed a new module in One Health in 2018. One Health is defined by the concept that human health, animal health, the environment and society are interconnected and therefore interdependent. Understanding health issues through the One Health lens requires a diverse background and ability to think across disciplines. For this reason, our One Health module includes course offerings not only from the science/medical sciences (as in our other modules), but also geography, sociology and environmental science. Two new courses were developed to support this module (One Health 3300A and 3600B) and an existing course in Comparative Animal/Human

Pathology course (Medical Sciences 4100F/G) was substantially revised and cross-listed for our One Health students (One Health 4100F/G coordinated by one of our new researchers, a veterinary pathologist, Dr. Patti Kiser) as well as the research project course (One Health 4980E).

Program Oversight

Our undergraduate BMSc modules and educational activities are managed by the Undergraduate BMSc Pathology Committee. The committee is comprised of undergraduate course coordinators, an undergraduate program administrator, the undergraduate program Chair and the Director of Education. This committee facilitates the development, implementation, ongoing management, and evaluation of the department's undergraduate Pathology educational activities. The Chair of this committee also has the responsibility to represent the department and to advise the Bachelor of Medicine Science Undergraduate Education (BMSUE) and Educational Policy Committee (EPC) at Western on matters related to the undergraduate educational programs in Pathology and Laboratory Medicine, including policies, practices and criteria for admission, evaluation, and promotion of undergraduate students.

The undergraduate Pathology BMSc underwent the cyclical Institutional Quality Assurance Process (IQAP) review in 2017. External reviewers highlighted strengths of our modules that included a broad faculty base, the quality of students entering our programs, and the diversity of our modules. The review also recommended that we focus our efforts in growing and evolving the program in three specific areas: a) Increase enrollment; b) Enhance students' opportunity to gain experience in effective written communication; c) Develop laboratory and research skills to support students going into 4th year projects. Since 2017, we have addressed all three of these recommendations increasing enrolment in all modules in the department programs (**Tables 5.2 and 5.3**), enhancing the number and variety of written assignments in all of our 4th year courses, and in developing a 3rd year laboratory course for our students (Pathology 3700F/G offered by Dr. Martin Duennwald).

Admission Requirements and Statistics

The **Honours Specialization Program (HSP)** in Pathology may only be completed within the BMSc Program. Students beginning their studies at the University will not register in modules leading to a BMSc degree until they are admitted to Year 3 of the BMSc Program. For more information. BMSc Program and Modules Offered in the BMSc Program.

Table 5.2: Enrollment and Admission Averages for Students in our Modules

Pathology Module					
Year 3	**2015-2016**	**2016-217**	**2017-2018**	**2018-2019**	**2019-2020**
Applications	25	33	22	21	29
Registered	20	19	16	22	18
Admission Average	87.00%	88.60%	84.40%	80.40%	86.40%
Year 4	**2015-2016**	**2016-217**	**2017-2018**	**2018-2019**	**2019-2020**
Applications	16	22	21	19	24
Registered	10	14	16	14	14
Admission Average	88.00%	89.53%	86.06%	79.12%	81.63%

Medical Health Informatics Module					
Year 3	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**
Applications	2	4	3	10	10
Registered	1	7	3	10	6
Admission Average	75.00%	75.00%	75.00%	75.00%	75.00%
Year 4	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**
Applications	4	4	7	4	10
Registered	3	3	3	0	7
Admission Average	75.00%	75.00%	75.00%	75.00%	75.00%

Biochemistry and Pathology					
Year 3	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**
Applications	12	9	18	12	9
Registered	7	8	6	3	8
Admission Average	84.50%	82.50%	90.50%	86.83%	76.33%
Year 4	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**
Applications	8	6	7	4	6
Registered	6	4	6	4	5
Admission Average	77.36%	75.00%	82.48%	75.00%	83.66%

Microbiology and Immunology and Pathology					
Year 3	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**
Applications	NA	14	16	6	9
Registered	NA	6	6	7	6
Admission Average	NA	88.17%	89.50%	91.67%	92.00%
Year 4	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**
Applications	NA	8	11	9	6
Registered	NA	2	9	7	4
Admission Average	NA	83.97%	83.81%	79.07%	79.07%

One Health					
Year 3	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**
Applications	NA	NA	4	10	13
Registered	NA	NA	1	5	10
Admission Average	NA	NA	75.00%	75.00%	75.00%
Year 4	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**
Applications	NA	NA	NA	1	7
Registered	NA	NA	NA	1	6
Admission Average	NA	NA	NA	75.00%	75.00%

Curriculum and Program Delivery

Specific course requirements for each BMSc module offered by Pathology and Laboratory Medicine are listed on the Western Academic Calendar. Outlines of courses in Pathology, One Health, and Medical Health Informatics are also available on our website. Enrollment in our courses has remained strong (**Table 5.3**).

Table 5.3: Enrollment in BMSc Courses Offered by Pathology and Laboratory Medicine

Courses	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
Pathology Courses					
Pathol 3240A	323	318			
Pathol 3245B	109	86			
Pathol 3500			159	130	151
Pathol 3700F/G		5	4	9	19
Pathol 4200A	25	30	41	26	33
Pathol 4400B	35	31	38	34	31
Pathol 4500B	20	26	30	14	17
Pathol 4980E	11	16	20	19	17
Medical Health Informatics Courses					
*MHI 4100F	6	11	7	4	20
*MHI 4110G	6	6	4	3	10
MHI 4980E	3	3	3	0	7
One Health Courses					
One Health 3300A					27
One Health 3600B					20
One Health 4100F/G					14
One Health 4980E				1	6

**Note: These courses are also taken by 4th year students in the Health Informatics stream of Software Engineering and by graduate students in the Health Information Science program. Numbers in the table represent only BMSc registrants.*

Assessment of Learning

During 2016-2017, in preparation for the IQAP review, the department undertook the task of developing program-level outcomes. Each course offered by Pathology and Laboratory Medicine, and respective mode of instruction and assessment, was then mapped on the program-level outcomes. The complete BMSc Pathology Self Study, external reviewers' report, and our response is available upon request.

The modules and courses offered by Pathology and Laboratory Medicine build on the foundation of Biochemistry, Anatomy and Cell Biology (i.e. human anatomy, histology), and Physiology. Students enrolled in Pathology modules take one full credit in Pathology (Pathology 3500) in their third year. The course assesses learning through four exams comprised of multiple-choice questions. Based on high enrollment numbers, the fact this course is delivered by clinical faculty and limited resources available (teaching assistantships), multiple choice questions are the best means to evaluate learning. Our third-year students also have the option of taking Pathology 3700G, a course that provides an opportunity to learn about research, laboratory procedures and to develop their writing and critical thinking skills. Students are evaluated primarily through writing essays, delivering oral presentations and in-class participation. Our third year students are also encouraged to supplement their education with work experience (Table 5.4).

Table 5.4: Number of Students on Internship

	Number of Students on Internship				
Module	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
Pathology		2		1	3
One Health					
MHI	1	1		2	3
Biochemistry and Pathology					
MNI/Pathology		6		1	2

In the fourth year, students take 3 half-credit Pathology courses (Pathology 4200A, 4400B, and 4500B). These courses have limited enrollment based on the material presented and course pre-requisites. Learning is assessed through written assignments as well as two to three examinations comprised of multiple-choice, short answer, and essay questions. Finally, students in the Honours Specialization module take Pathology 4980E and conduct individual research under the supervision of a Pathology and Laboratory Medicine faculty member. The course introduces students to the spectrum of scientific research. Achievement in this course is evaluated through oral presentations, written reports (i.e. research proposals and final research manuscripts), poster presentations, and in-class discussions.

Assessment methods for students in MHI HSP and One Health HSP are similar to ones described above for Pathology HSP.

Student Awards

Excellence of our undergraduate BMSc trainees is recognized by two departmental awards given to top performing students in courses, a research day award, as well as the Gold Medals that are awarded by the University Board of Governors for the highest standing in an Honors Specialization or Specialization module. Undergraduate student award recipients are listed on our website.

The ***Frederick N. Lewis Prize*** is awarded in memory of Dr. Fred Lewis who was a member the department. This prize is given to the undergraduate student who obtains the highest grade in the Path 3240a Understanding Diseases course. Since this course is no longer offered, discussions are ongoing to put the funds toward another award. Award: $150, awarded annually.

The ***Professor Colin Anderson Award*** is awarded in memory of Professor Colin Anderson who was a member of the Pathology staff. The Prof. Colin Anderson Award is given to the undergraduate student with outstanding performance in our capstone research project course (Pathology 4980E). Award: $150, awarded annually.

Quality Indicators

The department strives for excellence in teaching and this is demonstrated by our award-winning faculty. A number of our faculty who teach Pathology courses or supervise 4th year thesis projects have won awards at the departmental, faculty (the Dean's award of Excellence) and university levels (e.g., University Students' Council Teaching Honor Roll) as well as prestigious national awards in the area of their teaching expertise (Canadian Health Information Management Association Tribute). Faculty award recipients are listed on our website.

Excellence is also demonstrated by the achievements of our students. In particular, in 2019 one of our 4th year Honors Specialization in Pathology students won an international summer research internship to conduct research at the University of Lausanne in Switzerland. Further, the inaugural graduate of our new One Health Program is now accepted to the MSc. program in Global Health, Oxford University.

Table 5.6: Subsequent Programs and Plans of Students in our BMSc Modules

Subsequent plan: MSc/PhD (supervisor initial)	
2016-2017	**Winston Chang** MSc, Harvard (2017); PhD Cornell (2019) (LC)
2017-2018	**Danielle Perro** PhD, Oxford University (SF)
2017-2018	**John Palmer** MSc, Western University (AP)
2018-2019	**Wan-Yu (Elisa) Chao** MSc, Western University (SC)
2018-2019	**Mihai Dumbrava** MD/PhD (fall 2020), Mayo Clinic, Rochester, MN, USA (MD)
	Ahmed Salem MSc, Western University (MD)
2018-2019	**Justin (Sanghun) Kim** MSc, Oxford University (SF, FOP)
2019-2020	**Joel Zhang** MSc One Health, Western University (FOP)
2019-2020	**Ayushi Bhatt** MSc, (offers from U of T, McGill); Medicine interviews (MD)

Subsequent plan: Medicine/Dentistry/Nursing	
2016-2017	**Karan Lall** Dentistry, Western University (MD)
2016-2017	**Cynthia Yeung** Medicine, Queens University (MD)
2017-2018	**Rumana Rafiq** Medicine, Dalhousie University (SF)
2017-2018	**Reid Vender** Medicine, Queen's University (AP)
2017-2018	**Jasper Ho** Medicine, McMaster University (AP)
2017-2018	**Karina Lenartowicz** Medicine, Mayo Clinic, Rochester, MN, USA (MD)
2017-2018	**Soojie Hong** Nursing, University of Toronto (MD)
2017-2018	**Anastasia Vinokurtseva** Medicine, Western University (EA)
2019-2020	**Sam Taheri** Dentistry, University of Toronto (SF)
2019-2020	**Navia Novosel** Dentistry, Indiana University (FOP)

Subsequent plan: Other Careers	
2016-2017	**Cornelius Nesen** Software Developer, IBM (AP)
2017-2018	**Enid Chan** Medical Editor, Klick (AP)
2018-2019	**Lisa-Monique Edward** Research Technologist, Hospital for Sick Children (AP)
2018-2019	**Ryan Gilles** Research Technician, St. Joseph's Hospital (EA)

Challenges and Opportunities

A major suggestion from the IQAP review of our undergraduate program in Pathology (available upon request) was to focus on succession planning. The Department has taken steps to offset the retirement of two faculty members particularly active in delivering our undergraduate courses. Dr. Candace Gibson (coordinator of MHI module) will retire in July 2020. The content of MHI courses is outside the area of expertise of the current complement of Pathology faculty and so plans have been made for this module to be transferred to the Department of Medical Biophysics.

Dr. Chandan Chakraborty (coordinator of Pathology 4200A and 4400B) has already retired but is still coordinating and teaching in these courses as a limited-term faculty member. Replacing his position is important to maintain the necessary complement of basic scientists in the Department and our ability to deliver these courses. We have recruited a few faculty in the last five years and

so discussion is underway on whether to transition these courses to other faculty members and tailoring the course content to align with their specific expertise.

Future Growth

Since 2015 we have seen an increase in our faculty, both on the basic and clinical side. These colleagues are contributing to the undergraduate teaching mission of our Department in various ways but due to the nature of pathology, drawing on basic science disciplines, some of these courses are listed in other departments. These include Biochemistry 3386B (Clinical Biochemistry), Biochemistry 4450A/B (Molecular Genetics of Human Cancer) and MNI 4750F/G (Bioinformatics of Infectious Disease). We are currently working on having these courses cross-listed to Pathology, since they are coordinated and taught by our faculty. We have also co-developed a new 4000-level course in Advanced Clinical Histology, which is currently going through Dean's Academic Programs (DAP) and EPC approval. This course will increase clinical faculty involvement with half the lectures being delivered by two of our Pathologists.

A number of our recent recruitments to Pathology and Laboratory Medicine have expertise in bioinformatics (Drs. A. Poon, P. Shooshtari, F. Dick). With these faculty members, we are exploring opportunities for contributing to the informatics initiatives on campus and developing an interdisciplinary offering with a focus on bioinformatics. We expect this module to initially have 3-5 students, but to expand as the commitment to computing at Western continues to grow, for instance the development of campus-wide first year course in computing.

5.2 Undergraduate Medical (Pathology) Education

Over the years, faculty members in our department have been actively involved in medical student teaching with strong administrative support from the Department of Pathology and Laboratory Medicine (PaLM) and Schulich Undergraduate Medical Education (UME). Our *goal* is to elevate the visibility of PaLM to medical students early in the undergraduate curriculum and enhance student consideration of Pathology as a career choice. We strive to train our students to achieve certain Pathology exit competencies we believe a graduating medical student should learn in preparation for and transition to residency. However, a challenge during the past year has been the planning and successful integration of PaLM into the renewed undergraduate curriculum.

Program Oversight

Dr. Driman, in his capacity as PaLM Education Director, runs education committee meetings and serves as an effective advisor. Dr. Joseph oversees Undergraduate Medicine (Pathology) Education as a whole and runs the Med 3 pathology educational activities with her team members. Dr. Weir actively serves in a number of UME Committees at the Schulich level (e.g. Accreditation committee and Quality committee (co-lead), Curriculum committee, Assessment committee, to mention a few). Over the years, Dr. Garcia served as the Vice Dean of Education at Schulich. Cheryl Campbell effectively takes on the administrative role related to undergraduate pathology education.

Renewed Schulich Undergraduate Curriculum Planning and Implementation:

The Schulich School of Medicine & Dentistry has been actively engaged in undergraduate medicine curriculum renewal effective September 2019 for Year 1 and Year 3 clerkship, and September 2020 for Years 2 and 4. The new curricular model is competency based with social accountability at its core.

Planning has been high level with building and mapping of competencies, EPAs and application of Medical Council of Canada based symptoms and learning objectives. Guidelines for assessment, teaching modalities and weekly schedules were created and shared with course and theme leads. Dr. Weir represents our department at the Schulich UME level and has organized CPD sessions for our faculty and students on CBME principles through our NERDs open forum and invited speakers.

In order to encompass the exciting and challenging needs of this new undergraduate curriculum, we expanded and restructured the existing departmental Undergraduate Medicine (Pathology) Education Committee as follows (Chair: Dr. Joseph, Members/ Sections: Drs. Weir and Walsh (Med 1&2 new curriculum), Dr. Tweedie (Med 1 &2 Interest group), Dr. Joseph (Med 3 Selective and Pathology case conference, assisted by Dr. Cecchini, resident), Dr. Ettler (Med 3 &4 Elective). Our major activities are given below.

A. Med 1 and Med 2 (Pathology Leads: Drs. Weir and Walsh)

The newly built Foundations course (16 weeks, year 1 semester 1) of new curriculum has been successfully completed (Sept–end of December 2019) with heavy involvement of PaLM faculty. This course followed the life cycle, then Blood and Infection/Immunity topics, and finished with consolidation activities. Actively involved PaLM faculty members are Drs. Weir and Walsh (Week Lead- 6), Dr. Sangle (Week Lead 10-13) and Dr. Delport (Week Lead 9, 14,15). A few other PaLM faculty members also participated in teaching during this course.

The newly built Principles of Medicine 1 course (19 weeks, year 1 semester 2) of new curriculum is currently running (January –June 2020). This course includes CVS, Respiration, GI and GU topics and finishes with Integration and consolidation. The development of Principles of Medicine 2 course (year 2 semester 1), and Transition to Clerkship (year 2 semester 2) are evolving. All these courses are heavily run by clinicians who function as Week Leads. Drs. Weir and Walsh serve as Pathology Leads for these courses. As seen in the schedule, PaLM faculty involvement is limited to few lectures and small group sessions. Efforts to improve PaLM faculty participation in few more relevant areas for next year are in progress.

B. Observership and Interest Group Sessions: (Pathology Lead Dr. Tweedie)

In addition to the above curriculum based courses, our department continues to provide one on one observership sessions for Med I and Med 2 students to witness and experience the life of a pathologist in a tertiary care centre. Our Medical Student Interest Group Session on "Introduction to the Multifaceted Field of Pathology" has been very well received by students.

C. Med 3 and 4 Clerkship (Pathology Lead Dr. Joseph with Team Members)

Pathology Education for Schulich Med 3 Clerkship Students, Surgery Rotation: There are currently two activities run by our department for Med 3 students in collaboration with the Department of Surgery and the plan is to maintain these in the new CBME curriculum. Student evaluations have been consistently high and there is enthusiastic support from Dr. Andreana Butter, the Surgery Clerkship Coordinator to maintain these activities in new curriculum.

1. ***Pathology Case Conference:*** This past academic year, we (Drs. Joseph/Driman/Cecchini) refined the existing "Pathology Exit Competency" document for our Meds 3 students. Our "Pathology Case Conference" learning modules (10 in total) which were developed on a variety of clinically relevant pathology practice topics (run 4 times a year, 1-hour session) are well received by students. Our popular hands on FNAB procedure and smear making session, given by our cytopathology team and residents is held in C-Star, University Hospital along with other surgery simulation sessions.

2. ***Pathology Selective (2 weeks):*** This selective is judiciously structured to include 10 faculty supervisors, a guide booklet for supervisors and students and a "Resident Buddy" System. Teaching and mentoring from pathologists and residents are highly regarded by students. Many students from this cohort have selected pathology as a career choice.

Pathology Elective (2 weeks) for Meds 3 and 4 Clerkship Students (Lead Dr. Ettler): This popular elective is offered to a number of medical students from Schulich and external universities. These are for students truly interested in a future Pathology Residency Program.

Student Awards

Dr. P.C. Shah Summer Clinical Training Experience in PaLM

The P.C. Shah studentship was established to encourage undergraduate medical students to pursue a career in PaLM involving community health services by enabling Schulich Med 1 and 2 students to work under the supervision of a PaLM faculty member. Award: $4,048 per year, funding from the Dr. Pravin C. Shah Fund, with matching funds from the PaLM.

Challenges of Undergraduate Medicine (Pathology) Education

With the rapid introduction of this year's renewed undergraduate curriculum (CBME theme), we are experiencing considerable changes in the content, method of teaching and assessment for Med 1 &2 courses. Formal classroom lectures for various courses are significantly reduced and lectures are replaced by innovative labs, small group and large group teaching sessions. Many existing pathology lectures and small group discussions in Med1, Med2 courses have been eliminated in this process. On the other hand, it is reassuring that the introductory Med 1 "Foundations Course" received pathology attentiveness and heavy involvement starting from the planning and building phase.

Looking Ahead

Over the years, our departmental members have worked very hard to elevate the visibility of PaLM specialty among medical students. Although we have seen some reduction in pathology teaching in the first two years of curriculum, we believe it is essential for medical students to understand and experience the role of pathology as a diagnostic service in the patient management pathway. We have a commendable collection of high- quality teaching material created by our faculty, and it is an opportune time to introduce relevant material in a revised format into the new curriculum utilizing evolving technology. We have passionate teachers and an atmosphere of innovation in our department and it is essential to accelerate pathology teaching involvement in the new curriculum with the ongoing guidance and direction of leaders in education.

For additional information, please visit Schulich's Undergraduate Medical Education website and the department website.

5.3 Undergraduate Dentistry

In the Schulich School of Dentistry, instruction in general and systemic pathology is introduced in the first year. Five full courses in pathology and oral pathology were offered to undergraduate and postgraduate dental students from 2015 to 2019, including:

A. Dentistry – Year 1:

Dentistry 5162 Systemic Pathology: (Course Director: Dr. Jeremy Parfitt) is a component of the General Medicine Unit and is a systems-based course which runs sequentially with Human Physiology, Pharmacology, Systemic Anatomy and Medicine. It examines specific aspects (etiology, clinical presentation, macroscopic and microscopic features, and pathogenesis) of common human diseases relevant to the practice of dentistry.

Dentistry 5170 Oral Diseases I: (Course Director: Dr. Mark Darling) is an integrated course covering common diseases of the teeth, periodontal and periapical tissues; specifically caries, gingivitis, periodontitis, pulp disease, periapical inflammation, regressive dental conditions and dental anomalies. It is designed to introduce the student to common maxillofacial and dental pathologies early in their dental school careers. Faculty engage the students in one small group discussion introducing them to the concepts of histopathology of common oral diseases.

B. Dentistry – Year 2:

Dentistry 5235 Oral Diseases II: (Course Director: Dr. Christina McCord) is a continuation of Oral Diseases I and is an integrated course combining oral medicine, oral pathology and oral radiology to cover a variety of diseases that affect the hard and soft tissues of the mouth, head and neck. Several faculty members engage the students in 6 small group sessions, encouraging discussion in the clinical and histopathological aspects of oral conditions.

C. Dentistry – Year 3:

Dentistry 5335: Oral Diseases III: (Course Director: Dr. Christina McCord) is a continuation of Oral Diseases II, but focused on the less common oral diseases that might be more infrequently seen by dentists. This included broader aspects of odontogenic, salivary, mucocutaneous and connective tissue diseases. Again, several faculty members engage the students in 7 small group sessions, encouraging discussion in the clinical and histopathological aspects of oral conditions.

D. Internationally Trained Dental Students – Year 1:

Dentistry 5304 (Oral Pathology (ITD1 only): (Course Director: Dr. Mark Darling) is a comprehensive review of the more common diseases affecting the orofacial region and jaws, excluding periodontal diseases; and is intended to be a comprehensive Oral Pathology refresher for these students who already have significant experience in treating oral and dental diseases.

5.4 Other Undergraduate Education Initiatives

Pathology for Nursing Students

The Department of Pathology and Laboratory Medicine offers a key course (Pathology 2420A) in general and systemic pathology to nursing students in two BScN programs at Western University: the Western-Fanshawe Collaborative BScN Program (4 yr) and the Compressed Time Frame (CTF) BScN (2 yr) Program. The course is offered in an online format to the CTF nursing students through the university's learning management system OWL and in a blended format with an added face-to-face tutorial component on each of the campuses in the Collaborative program.

Total course enrollment numbers are approximately 350 (2019-2020) students and assistance is offered through a full-time Graduate Teaching Assistant (10 hours/week). Dr. Candace Gibson coordinated this course until December 2019 and upon her retirement on July 1, 2020, it will be taken over by Dr. Emily Goebel for September 2020.

Pathology for Imaging Sciences Students at Fanshawe College

MRIP6004/MRIP6005 is a course for Imaging Sciences (MRI) students from the Health Sciences/ Imaging Division at Fanshawe College in London. This course is a part of the multidisciplinary one-year graduate program involving Radiology and Pathology and Laboratory Medicine departments from Western and the Health Sciences/Imaging division of Fanshawe College. The course discusses the systemic pathology of different body systems including head (brain) and neck, musculoskeletal (joints, bone, spine), thorax (respiratory system, mediastinum, cardiovascular), pelvis (male/female reproductive systems, kidney, urinary system) and abdomen. Pathologies that commonly require an MR study are discussed. The course was fully developed by Pathology and Laboratory Medicine faculty, and four Pathologists from our Department prepare material and PowerPoint lecture notes for the students. This course is coordinated by Dr. Manal Gabril and her Pathologist colleagues. No changes are foreseen for this course.

6. Graduate Education

6.1 Research-Based Graduate Programs

The Department of Pathology and Laboratory Medicine offers research-based (thesis) Master of Science (MSc) and Doctor of Philosophy (PhD), as both full-time and part-time degree programs. Two fields of research (areas of specialization) are available to MSc and PhD students: Pathology and One Health.

Research Field in Pathology: Pathology is the scientific study of disease processes. Pathology applies basic research techniques in biochemistry, cell biology, genetics, immunology, and molecular biology to the study of mechanisms of cell and tissue injury and the pathogenesis of disease.

Research Field in One Health: The Department developed and launched a new research field of One Health for graduate students in 2018. One Health is an integrated effort across multiple disciplines working locally, nationally and globally to attain optimal health for humans, animals and the environment. Students in the One Health research program take a wholistic approach to studying human health and disease by examining the intricate link between disease drivers (i.e. social determinants, environmental factors, and animal health) and human health.

Key Highlights Since Self-Study in 2015:

- ☑ Developed and launched, the first of its kind academic research field of One Health at the graduate level
- ☑ Developed an innovative Graduate Diploma program
- ☑ Recruitment of basic scientists and clinician-scientists to maintain graduate student enrolment supervision and to ensure future growth
- ☑ Establishment of new graduate trainee awards and scholarships
- ☑ Successful completion of Institutional Quality Assurance Program review of the Research-based Graduate Program in 2017, which was highly positive.

Program Description and Objectives

In 2016-17, all educational programs offered by Pathology and Laboratory Medicine, including the research-based graduate programs, underwent an Institutional Quality Assurance Process (IQAP) review. As part of the review, we undertook the daunting task of devising program-level outcomes for our programs. These program-level outcomes for the research-based MSc and PhD programs are outlined in our Graduate Student Guidelines (pages 10-13 in the guidelines). These outcomes clearly describe what our students will be able to know (knowledge), do (skills), and feel (attitude) by the end of our MSc and PhD programs.

External reviewers' report, submitted as part of the cyclical IQAP review, did not identify any weaknesses in our graduate program but made minor recommendations to enhance it. Some of these have already been implemented in our program offerings. A copy of our graduate program self-study, external reviewers' report, and our response to Senate are available upon request.

The objective of our research-based programs is to train tomorrow's researchers who will make significant original contributions to the global understanding of disease diagnosis and mechanisms.

Graduate students perform investigation at the molecular, cellular, tissue, whole organism, and clinical levels. As part of the program, our students conduct supervised research in various thematic areas including cancer, diabetes, transplantation, stem cell biology, neurodegenerative diseases, cardiovascular disease, developmental defects, medical molecular cytogenetics, and One Health.

Graduates of our research-based program are qualified for a diverse set of careers including, but not limited to, academia, government, and the pharmaceutical industry. Our curriculum has been developed in such a way so that our graduates can follow various paths for fulfilling their future career dreams. Though many of our past graduates have become successful Biomedical Scientists in academia and pharmaceutical industries, many others have also gone to professional schools to become clinicians, dentists, other health professionals, lawyers and business administrators in biotech companies.

6.1.1 Oral and Maxillofacial Surgery Graduate Program

The division of Oral and Maxillofacial Surgery of the Schulich School of Medicine & Dentistry offers a six-year graduate program in which dentists study medicine leading to an MD degree, are trained in oral and maxillofacial surgery leading to eligibility to write specialty exams in Canada and the United States, and complete a MSc research program within the Department of Pathology and Laboratory Medicine at Western. This program started in 2007 and has continuity offered quality research training to one student admitted each year. Student are selected by a committee composed of oral surgeons, and representatives of the Schulich School of Medicine & Dentistry, and from Pathology and Laboratory Medicine. For the MSc component of the dual-degree program, students are supervised by members of the Division of Oral Pathology within Pathology and Laboratory Medicine. In almost all cases, these students are supervised by a basic scientist from Pathology and Laboratory Medicine or other department at Schulich Medicine & Dentistry.

6.1.2 Collaborative Specializations

Western University offers a number of Collaborative Specializations. A Collaborative Specialization is an intra-university graduate field of study that provides an additional multidisciplinary experience for students enrolled in, and completing the degree requirements for, one of a number of approved MSc and/or PhD programs. Students meet the admission requirements of, and register in, the participating (or "home") program and complete, in addition to the degree requirements of that program, the requirements listed by the Collaborative Specialization. Please refer to Collaborative Specializations for available fields of study. A number of our graduate students have participated in collaborative specializations. Typical fields of specializations which couple well with research expertise of our graduate faculty and students include Developmental Biology (3 recent graduate students), Molecular Imaging (2 recent graduate students), and Musculoskeletal Health Research (2 recent graduate students).

6.1.3 'One Health' Research Field

The Pathology and Laboratory Medicine graduate program has a strong history of productively promoting research between basic and clinical, and quantitative and qualitative investigators that it continuously seeks to strengthen. Through extensive asset mapping at Western, we have developed a new interdisciplinary field of research in One Health within our MSc and PhD programs to address the drivers that are changing disease landscapes and dynamics as a result of human-animal-environment interactions. One Health breaks down barriers to resource sharing and academic collaboration and provides interdisciplinary research training by utilizing research

expertise and supervision from across Western. Unlike other education and research programs at Western, in Canada, or the world, this interdisciplinary and integrated graduate program aims to provide unparalleled breadth and depth of knowledge in human health. We accepted the first 2 MSc graduate students performing One Health research in 2019. Two additional students have accepted our One Health MSc program offer for Fall 2020.

6.1.4 Development of an Innovative Graduate Diploma Program

Based on a continuous dialogue between current undergraduate and graduate students, course instructors and research supervisors, and the directors of the various education programs offered by the Department, we have identified an emerging gap and an important market for a one-year, research-intensive, graduate diploma training program. In our assessment, a one-year graduate research training program will be appealing to both domestic and international undergraduate students and professional program students.

The diploma program was approved by Subcommittee on Program Review - Graduate (SUPR-G) in February 2020, and by Senate Committee on Academic Policy and Awards (SCAPA) in March 2020.

We anticipate that the Graduate Diploma program will launch in 2021. We will build enrollment by capitalizing on our on-going research collaborations between Pathology and Laboratory Medicine faculty and international researchers, which will also enhance international student enrolment. These research linkages include collaborators in China, US, Brazil, Israel, and Germany. Students from the laboratory of our collaborators in China and other countries are currently visiting the Pathology and Laboratory Medicine at Western as research-only Visiting Graduate Students (VGS) for 1-2 years, regularly and at a high level. A one-year structured training program at Western will enhance these collaborations and increase enrolment of students from our partner institutions.

We also anticipate subscription by undergraduate students and professional program students (e.g. Doctor of Medicine and Master of Public Health program) who are interested in biomedical research. Since 2005, approximately 15-20% of Pathology undergraduate students from Western spend one year working or volunteering, before (re)applying to professional schools.

Therefore, this new diploma program will help both students and researchers. A critical and unique component of the Graduate Diploma in Pathology and Laboratory Medicine is a mentored 1-year individual research project at the graduate level. The scope and intensity of the research project will be identical to one year of the currently offered MSc and PhD programs by the Department. In addition to developing and expanding research skills, students will enroll in courses specifically designed to introduce them to research terminology, theoretical research underpinnings, modern experimental models of human disease, and critical appraisal of scientific literature.

Program Oversight

The Graduate Education Committee (GEC) that consists of nine members including one graduate student (elected by graduate students in the program) is responsible for maintaining the quality of the program. The GEC meets once a month and discusses course requirements, assesses overall performance of every graduate student in the program and takes necessary action(s) either immediately or through implementation of new policies by updating Graduate Students' Guidelines at the end of the year. The GEC also prepares and participates in the cyclical IQAP review and in responding to the reviewers' comments through implementing changes, as needed.

Admission Requirements and Statistics

Students entering our graduate program have typically completed a 4-year undergraduate science program, graduate program in medical/public health, or a professional degree in either dentistry, medicine or other health profession. There are no degree or course prerequisites for our graduate program as it largely depends on the research scope. However, students are encouraged to have taken courses in biological and medical sciences (e.g. molecular biology, anatomy, biochemistry, physiology, and immunology).

The number of applicants interested in the Research-based Pathology and Laboratory Medicine graduate programs (Table 6.1), our enrolment (Table 6.2), and the number of graduating students (Table 6.3) remain strong. When research funding is dwindling across Canada, we have been able to maintain enrolment in the program through recruitment of basic scientists (Drs. Art Poon, Bekim Sadikovic, Stephanie Frisbee, Francisco Olea-Popelka, Parisa Shooshtari, and Fred Dick), clinician-scientist (Dr. Qi Zhang), and providing cross-appointment to researchers in clinical departments without a research-based graduate training program (e.g. Drs. Saman Maleki [Oncology], Rabindra Bhattacharjee [Surgery]). Most of these new graduate faculty members are now supervising a graduate student in Pathology and Laboratory Medicine (9 graduate students being supervised by these newer graduate faculty). We anticipate that our enrolment will grow steadily over the next few years. Efforts in enhancing our research capacity (Section 9.0) will ensure that we continue to provide quality graduate training to MSc and PhD students at Western.

Table 6.1: Graduate Student Applications and Admission Grade Average

	2014	2015	2016	2017	2018	2019
Number of applications	50	55	52	47	45	64
Admission average (%)	82.48	82.6	82.2	83.9	86.65	82.14
Number admitted	10	13	10	9	12	10

Table 6.2: Enrolment in Graduate Programs

Year	MSc (FT)	MSc (PT)	PhD (FT)	PhD (PT)	Total (FT)*	Total (PT)
2014-2015	31	4	5	1	**36**	**5**
2015-2016	30	3	11	1	**41**	**4**
2016-2017	31	3	12	0	**43**	**3**
2017-2018	28	2	17	0	**45**	**2**
2018-2019	33	1	14	0	**47**	**1**
2019-2020	34	1	10	0	**44**	**1**

** Includes 12 MClSc Pathologists Assistant Students each year (FT)*
Source: Office of Institutional Planning & Budgeting (IPB) at Western [(FT) = full-time; PT = part-time]

Table 6.3: Number of Students Graduating from the Research-Based Programs

Year	MSc	PhD
2014	6	5
2015	6	1
2016	12	1
2017	5	3
2018	5	4
2019	7	1

Curriculum and Program Delivery

MSc and PhD students complete a set of required courses. Generally, these courses include an introductory/survey course on the research field (Pathology or One Health; 1 term), a set of research seminar courses (2 years for MSc students and 4 years for PhD students), and a research methodology course (1 term). Students in the Pathology research field are also required to take a scientific writing course (1 term). Details on these courses can be found in our Graduate Student Guidelines (pages 15-18 of the guidelines). Additional course work may be selected on the advice of a candidate's supervisory panel. It typically depends on the student's prior experience and is be oriented towards strengthening their background knowledge and other specific requirements of the thesis topic.

All graduate students are required to present their research work at our annual Pathology and Laboratory Medicine Research Day (see **Section 9.0** for details). We invite high-profile researchers to deliver the keynote address. Students' presentations (platform and/or poster) are evaluated by the keynote speaker, invited external clinician/scientists, and participating faculty members serving as judges for the day. Up to three prizes are given to our research-based graduate students for the best platform and poster presentations. In addition, we present other awards to graduate students at this event.

A thesis is required for both MSc and PhD degrees. Every candidate must defend his/her thesis at an oral examination. A catalogue of our graduate student dissertation is available at our Pathology thesis catalogue. PhD students are required to take a comprehensive examination at the end of the first year. No significant changes to program delivery and curriculum are anticipated in upcoming years.

Assessment of Learning

Students admitted into the MSc or PhD program are assigned to a thesis supervisor. The supervisor, together with the student, sets up an Advisory Committee and determines a research project for the student. Students are then required to meet regularly with their Advisory Committee to assess progress. A detailed Advisory Committee Report is prepared by students and provided to the committee members. This report eventually takes the form of a manuscript and even the student's graduate thesis. The report as well as the evaluation form completed by the committee following the meeting is reviewed by the Graduate Education Committee. If there are any concerns, these are raised early and addressed promptly to ensure good student progress. Students who show promise and an aptitude for advanced research are recommended by the advisory committee to apply to transfer to the PhD program. As illustrated in **Table 6.2**, we have maintained a healthy PhD enrolment number.

Student Funding and Awards

All full-time graduate students in the research-based programs are provided with a strong financial package. For MSc students, the support level is approximately $19,500/year for 2 years. For PhD students, the level is set at approximately $30,000/year for 4-5 years (depending on direct entry or MSc to PhD transfer). This support comprises different sources, including supervisor's research grants. The level of support for both MSc and PhD aligns with other basic science departments at Schulich Medicine & Dentistry.

In addition to the annual financial package, we support the research activities of our graduate students through a number of internal awards and scholarships. A detailed list of awards is available on the Departmental Awards webpage.

Briefly, there are funding opportunities for students to participate in scientific conferences (Dutkevich Memorial Foundation Travel Award [value $1000/2 awards] and Dr. Frederick Winnett Luney Research Award [value $1200/4 awards; established in 2016]). Three scholarships of $5000 each are also available to research-based graduate students [established in 2016]. Eligibility and selection criteria for these scholarships is aligned with the Ontario Graduate Scholarship (OGS). Graduate students may also apply for the PC Shah Graduate Student Publication award [value $1000/1 award; established in 2017] to recognize a first-authored research publication. Finally, students exhibiting academic and research excellence may apply for the Cameron A. Wallace Award in Pathology [value $1500/1 award] as recognition of their efforts. For Dr. Frederick Winnett Luney Research Award and Scholarship, priority is given to students conducting collaborative research, in an effort to enhance teamwork and engagement between basic and clinical members.

In 2019, we also established a One Health Research Award. This award provides stipend support for graduate students in the One Health research field and enhances One Health research activities in the Department. Two graduate students (starting Fall 2020) have been awarded the One Health Research Award.

Our trainees have an excellent record of securing external scholarships and being recognized for their research excellence. Some of these recognitions have included the prestigious Natural and Engineering Research Council (NSERC) and Canadian Institutes of Health Research (CIHR) Master's and Doctoral Awards, ALS Trainee Award, and Gastroenterology Student Award.

A listing of graduate student award recipients can be found on the website. For a small department such as ours, these awards, in number and prestige, speak volumes about the quality of graduate training offered.

Quality Indicators

Quality Indicators for our graduate programs include, but are not limited to, faculty recognition for excellence in teaching (refer to website listing of teaching award recipients), student recruitment, retention and graduation rates (Tables 6.1-6.3) and success post-degree.

In addition, our program undergoes an Institutional Quality Assurance Process (IQAP) every 7 years and during our last IQAP review in 2017, our program was deemed to be of "Good Quality", which is the highest ranking a program can achieve.

Challenges and Opportunities

Our MSc and PhD programs are in excellent health with competent and dedicated staff and faculty who are providing excellent training to MSc and PhD students. Unstable research funding, affecting most departments, schools, and institutions, is perhaps the single most important challenge. We have maintained our strong enrollment numbers by growing our faculty complement. We are in the process of launching a 1-year graduate diploma program to attract students and to provide intensive research training, and to support our research faculty. As noted earlier, a number of our faculty members have on-going research collaborations with investigators at institutions across the world. Dialogue with our faculty revealed that a one-year structured training program at Western will enhance these collaborations and increase enrolment of students from our partner institutions. In addition to international students, a graduate diploma program in pathology will be attractive to undergraduate students seeking an additional year of training. The program has been developed, approved by Senate at Western in March 2020, and will be launched for Fall 2021. Details on the program structure and quality indicators/assessment methods are available upon request. Based on the steps we have taken, we have full confidence that our graduate program will remain strong and continue to attract excellent trainees.

6.2 Pathologists' Assistant Professional Graduate Program

The Pathologists' Assistant graduate program at Western University was the first of its kind to be accredited in Canada by the National Accrediting Agency for Clinical Laboratory Sciences. Our program was established in 2007, initially as an MSc course and practicum based program. In 2012, the program was approved as a professional program leading to a Master of Clinical Sciences – Pathologists' Assistant degree.

Pathologists' assistants (PAs) are highly trained healthcare professionals who work under the supervision of a pathologist to provide a broad range of services in anatomical pathology. The extra technical skills brought to the laboratory by PAs standardize and enhance the overall quality in the practice of anatomical pathology. PAs assume the major responsibility for the initial examination and dissection of all surgically removed tissues and, to a variable extent, for the dissection and gathering of material for ancillary studies at postmortem examinations. They play an integral role in patients' diagnoses and subsequent management and treatment plans.

Further information on the PA Program is available on our website.

Program Description and Objectives

The PA program's major objectives include training students to become healthcare professionals, experts in their technical field, with good communication and collaboration with team members. Graduates will engage in scholarly activities with a critical thinking and lifelong learning lens, while recognizing their roles managing patient material in the laboratory. As the country's first accredited program, our graduates will be leaders in this profession in our communities.

The program's objectives are mirrored after the CanMeds framework for trainees developed by the Royal College. These objectives are outlined in our Graduate Student Guidelines (pages 10-11 in the guidelines). These outcomes describe what our students will be able to know (knowledge), do (skills), and feel (attitude) by the end of the program.

The students' learning outcomes are also met through a mandatory research assignment and research presentation as well as practicum experiences in the hospital laboratory setting with real patient pathology material.

Program Oversight

The Graduate Education Committee (GEC), which consists of fifteen members, including student, preceptor and Toronto placement representatives, is responsible for maintaining the quality of the program. The GEC meets monthly to discuss course requirements, assesses overall performance of every student, and takes necessary action(s) either immediately or through implementation of new policies. The GEC reviews recommendations from the Admissions Sub-Committee and adjudicates internal award competitions. It also prepares and participates in the cyclical IQAP review and in responding to the reviewers' comments through implementing changes, as needed.

Admission Requirements and Statistics

The PA program is highly competitive (**Table 6.1**). Only six (6) students are selected each year. This is to ensure that each student receives maximum opportunities for hands on skills on real time patient material in surgical and autopsy pathology.

Table 6.1: PA Student Applications and Admission Grade Average

	2015	2016	2017	2018	2019
Number of Applicants	100	107	113	138	127
Number of Students Admitted	6	6	6	6	6
Admission Grade Point Average	83.9	86.4	82.5	82.4	86

Curriculum and Program Delivery

The program is 22 months in duration. It consists of first year coursework (8 months) followed by a 1 month orientation to the medical laboratory. Finally the practicum experience consists of 13 months of rotations in surgical and autopsy pathology at large centres (i.e. pathology laboratories at London Health Sciences Centre, Mt. Sinai Hospital in Toronto, the Hospital for Sick Children in Toronto, and the Ontario Forensic Pathology Services. During the last two months of training, students go to a community hospital pathology laboratory where they work more independently at a smaller site. Community hospitals currently affiliated with our program include those in Kitchener, Guelph, St. Thomas, Owen Sound, Sault Saint Marie, Mississauga, North York, Markham, and Chatham.

In addition to their hands on practicum training, students are required to complete a research project. Research project topics range from quality assurance, education, laboratory management, and basic science themes. They are also required to present their work at the Department of Pathology and Laboratory Medicine's annual research day. Many students also present their work at the Ontario Association of Pathologists (OAP) and Canadian Association of Pathologists' (CAP) meetings. As of 2019, students are also required to complete and present a case report.

Course	Title	Term
PATHOL 3500	Introduction to Human Pathology	September – April
PATHPA 9561A	Functional Histology	September – April
PATHPA 9562A	Infectious Diseases & Pathology	September – April
ANAT 9560	Human Anatomy, Embryology	September – May
PATHPA 9550B	Intro to Forensic Sciences	January – April
PATHPA 9551B	Intro to Forensic Sciences – Special Topic	January - April
PHYSIO 2130	Human Physiology	September - April
PATHOL 9563Q	Gross Teaching Session	May/June, 2nd yr orientation
Non-course Milestones		
PATHPA 9575	Gross Surgical Rotation	
PATHPA 9570	Autopsy Rotation	
PATHPA 9585	Research Project	

*Note: Course descriptions for the course above can be found **here**.*

Assessment of Learning

First year coursework is evaluated by written and oral examinations, written papers, presentations, and projects.

Students must complete all first year coursework with an average grade of at least 70%, and with no individual grade less than 60%.

Students must also successfully complete all clinical rotations in surgical and autopsy pathology, including all clinical placements.

The practicum uses a competency based education model. Students are observed on their hands on skills in processing of surgical specimens from all major organ systems. They are also evaluated for their hands on skills in postmortem examinations. An oral examination with assessment by a pathologist and PA preceptor occurs after every 1-2 month clinical rotation. Student progress is reviewed by the program's medical directors and at the monthly Graduate Education Committee meetings.

Finally, students must complete a mandatory research project, which is presented at our annual departmental research day. This year, due to COVID-19, these presentations occurred virtually. A final report, in manuscript format is submitted to the supervisor.

Sample topics from the research project poster presentations in 2020 include:

- LHSC breast sentinel lymph node protocol revisited: a quality improvement initiative.
- Is reflex immunohistochemistry for cytomegalovirus in colonic biopsies from patients with IBD warranted?
- Reflexive special staining of gastric biopsies for the detection of helicobacter pylori is not cost effective.
- Selective sampling as opposed to entire submission of prostate specimens from radical prostatectomies and cystoprostatectomies in Canada.

Student Funding and Awards

As a professional program, unlike the research-based programs, PA students are not eligible for institutional funding sources (e.g. Western Graduate Research Scholarships) and they cannot apply for provincial or national external scholarships (e.g. Ontario Graduate Scholarship). Therefore, the department allocates an annual budget to provide PA students with travel awards and bursaries and have developed internal research awards to recognize excellence in our trainees. These include the graduate bursaries [value $1000/up to 6 awards], the Dr. Frederick Winnett Luney Graduate Scholarship [value $1000/1 award] and the Dr. Subrata Chakrabarti PA Student Award of Excellence [value $1000/1 award].

It is also worth noting that our students' research has been recognized externally with "best poster" distinctions at both OAP and CAP events.

Please refer to our website for a listing of graduate student award recipients, including PA students.

Quality Indicators

Since 2015, we have had a 100% graduation rate amongst students enrolled in the program and employment opportunities have been excellent.

There are very few accredited pathologists' assistant training programs in North America and thus the demand for our graduates is high. Graduates from our program are working in provinces across Canada, from British Columbia to the Maritimes, as well as in the USA.

Since 2007 when our program began, all our alumni seeking employment upon graduation found jobs as PAs. Most students even received job offers before graduation. A few graduates chose to continue their education.

Our program has a pass rate of 100% in the new Canadian certification examination. Since 2015, there have also been fourteen (14) of our graduates who have written the American Society of Pathologists' Assistant board examination for PAs with a 100% pass rate.

Accreditation

The Department of Pathology and Laboratory Medicine's PA program is the first to be accredited in Canada by the National Accrediting Agency for Clinical Laboratory Science (NAACLS). We achieved accreditation in 2010 and renewed in 2015 for a 7 year term.

Accreditation allows our graduates to qualify to write the American Society for Clinical Pathology's Board of Certification Pathologists' Assistant examination. This certification opens up opportunities for more job opportunities, promotions and competitive salaries for our graduates. Our students are also eligible to represent NAACLS accredited programs at the annual American Association of Pathologists' Assistants (AAPA) conferences.

NAACLS is an American based clinical laboratory accrediting agency. At the time of our program's establishment, there was no equivalent accreditation body in Canada. The Canadian Association of Pathologists now have a PA section, including a certification examination. We are proud to have some our students involved in the leadership of this new profession.

Further information about NAACLS and our program listing can be found here.

Our program was also more recently reviewed by Western University's Senate Subcommittee on Program Review-Graduate (SUPR-G) in 2017. The external and internal reviewers conducted an on-site review of the program on November 14-15, 2017 as part of the Institutional Quality Assurance Process (IQAP) for reviewing graduate programs. In 2017, SUPR-G recommended that our program be classified as one of "good quality".

The full IQAP report, the reviewers' recommendations and our response to the reviewers, are available upon request.

7. Postgraduate Education

7.1 Anatomical Pathology Residency Program

The Anatomical Pathology (AP) residency program consists of 10-11 residents at any one time. Throughout 2015 to 2019 the Program has successfully filled the two available positions per year, with the exception of 2019-2020 (when the program had only one spot due to reallocation by the PGME Office). In addition to pathology residents, there is also a steady stream of other learners in the department, including elective off-service residents, medical students and observers.

The AP residency program underwent accreditation review by the Royal College in November 2019. The program received a recommended status of "Accredited program with follow-up by regular review". The final decision of the Residency Accreditation Committee is expected in the spring of 2020.

As of July 2019, the AP residency program has fully adopted the competency based medical education initiative called Competency by Design. The program uses time as a framework and is structured to take place over five years out of London Health Sciences Centre's University Hospital. The rotations are designed to ensure that residents are able to fulfill all of the goals and objectives of training and successfully complete the required Entrustable Professional Activates (EPAs) to acquire the necessary knowledge to practice as competent consultant pathologists.

With the exception of the clinical rotations in the first year of training, residents are mainly located in the Department of Pathology and Laboratory Medicine at University Hospital. Residents go off-site for frozen section coverage at other hospitals (St. Joseph's Health Care, London) or to attend academic events or rounds. Residents also have exposure to, and participate with, the Regional Forensic Unit, as well as the Neuropathology residency program and adjacent departments within the Schulich School of Medicine and Dentistry, all within close geographic proximity.

All anatomical pathologists are involved in resident education, specifically through participation in daily subspecialty surgical pathology sign-out, autopsy, and frozen section coverage. On any given day, most pathologists are on site and interact in the handling of service and consult work, resulting in a comprehensive and cohesive learning experience for the residents. This provides a broad practical exposure and opportunity for role-modeling.

There are numerous educational rounds throughout the academic year. Residents participate in teaching medical student small group sessions, peer to peer teaching through oral presentations and as part of weekly Academic Half Days.

Resident research is a requirement of training. Research is presented alongside graduate students at the Annual Departmental Research Day, in the Spring of each year.

Program Description and Objectives

The overarching goal of the training program in anatomical pathology is to provide residents with high quality training in all areas of the specialty. In addition to receiving training in all major areas, residents are allowed significant flexibility to tailor their training to suit their individual career goals and encouraged to develop areas of scholarly interest. At the conclusion of the training period,

residents have the skills necessary to pass the Royal College examination and function as effective and skilled consultants to their clinical colleagues.

The objectives are organized according to the seven competencies of the CanMEDS roles from the Royal College of Physicians and Surgeons of Canada's Canadian Medical Education Directions for Specialists. This delineates a competency framework to assist future specialists in responding to challenges as health-care providers. These challenges require specialists to function in a healthcare system in a constant state of flux and increasing fiscal constraints, while still providing the best specialty care. The CanMEDS roles framework lies at the core of postgraduate medical education in Canada and its goal is to make objectives and strategies for learning explicit by consolidating and organizing them into a uniform framework that can be modeled nationally, across the medical specialty curricula.

Please refer to the website for the Anatomical Pathology Residency Program's Goals and Rotation Specific Objectives (CBME; PGY1) and Goals and Rotation Specific Objectives for PGY2-PGY5 for more information.

Program Oversight

The Program Director (Dr. Aaron Haig) along with the Residency Program Committee (RPC) are responsible for planning, organizing, evaluating, and advancing the program. The RPC's role is to support the Program Director and therefore reports to the Program Director, who in turn has a dual accountability to the Department Chair and to the Associate Dean for Postgraduate Medical Education.

Admission Statistics

The residency program offers two (2) positions per year through the Canadian Residency Matching Service (CaRMS). From 2015-2020, these positions have been filled through the first or second iterations

Curriculum and Program Delivery

A. Educational Experience (Rotation) by Year for Anatomical Pathology (non-CBD)

Year	Content and Sequence of Rotations Months or 4-Week Blocks												
	1	2	3	4	5	6	7	8	9	10	11	12	13
PGY1	General Surgery		General Internal Medicine	Medical Subspecialty or Pediatrics	Emergency	Radiation Oncology	Gyneco-logical Oncology	Urology	Gastro-enterology	Hemato-logical Oncology	ENT surgery	Anatomical Pathology	Elective
PGY2	Core Surgical and Autopsy Pathology												
PGY3	Core Surgical and Autopsy Pathology												
PGY4	Neuropathology		Cytopathology			Core Surg. Pathology	Electives						
PGY5	Electives				Cyto-pathology	Molecular Genetics	Senior Surgical and Autopsy Pathology						

B. Educational Experience (Rotation) by Year for Anatomical Pathology (CBD)

Year	Content and Sequence of Rotations Months or 4-Week Blocks												
	1	2	3	4	5	6	7	8	9	10	11	12	13
PGY1	Introduction to Pathology	General Internal Medicine	Pediatrics Emergency	Gynecological Oncology	Medical Oncology	ENT surgery	Gastro-enterology	Hemato-logical Oncology	General Surgery	Laboratory Basics			Molecular
PGY2	Core Surgical and Autopsy Pathology												
PGY3	Core Surgical and Autopsy Pathology (including Neuropathology and Cytopathology)												
PGY4	Core Surgical and Autopsy Pathology				Cyto-pathology	Molecular Genetics	Electives						

PGY1/Foundations: The first year of training is a broad-based clinical year that includes rotations in clinical medicine and surgery, as well as anatomical pathology. The year is intended to provide the resident with exposure necessary to prepare for the MCCQE Part II examination and to prepare the resident for training in pathology.

PGY2-PGY5/Core-Transition to Practice: In the core years, the residents rotate through autopsy and the various subspecialty surgical pathology areas. The overall time periods in each area are fixed, predetermined by the residency training committee in consultation with the team leaders, based on what is judged to be necessary to achieve adequate competency levels. In addition, there are introductory blocks in cytopathology, basic molecular pathology, cytogenetics, and peadiatric pathology. Mandatory senior rotations include cytopathology, neuropathology, and renal/soft tissue pathology, along with ample elective options, including community hospital experience. In the final year there is a senior rotation in anatomical pathology with an emphasis on increasing responsibility. There are also rotations in molecular pathology and cytogenetics, and an additional cytopathology rotation. The remaining blocks are elective time; rotations can be spent in a broad range of activities (see "Electives" below).

Educational Program: The educational program is comprehensive. An academic half day is held weekly, and during this time, residents are excused from all service responsibilities. The half day takes the form of didactic and seminar style teaching, as well as practical microscopic sessions. The educational curriculum covers a broad range of anatomical pathology topics as well as Laboratory Management, Quality Assurance, Critical Appraisal, and Bioethics. In addition to academic half days there are almost daily grossing rounds at which interesting specimens are triaged and discussed prior to processing, weekly Wednesday noon rounds where interesting cases are shared among departmental members, and weekly forensic autopsy rounds. There is a monthly Journal Club and monthly Grand Rounds. There are also a variety of weekly, monthly or quarterly clinicopathological rounds e.g. Pulmonary Pathology, GI/Liver Pathology rounds, as well as Tumour Boards.

Residents are required to keep Personal Learning Portfolios, to log cases, teaching and research activity. This serves as a resource for monitoring their service and educational activities and is an effective aid to the development of life-long learning strategies.

Electives: The total period of time available for electives is eleven (11) blocks. There is a wide choice of electives for the trainee to consider. These can include rotations in specific subspecialty areas of pathology (e.g. gynecological or hematopathology) or in research areas as noted below. Residents may organize elective rotations at other academic institutions. Residents may take electives in community hospitals in order to broaden their experience of day-to-day pathology practice. They may also take electives in hematology, chemistry or microbiology if they are considering practicing in a community hospital setting. Overall, the elective program allows residents to explore possible avenues of career choices, and also to tailor their training to achieve their own personal goals.

Research: Opportunities exist for residents to do research in a wide range of areas, including both clinicopathological research and bench research. Residents are expected to participate in the annual departmental Research Day; this is optional in the PGY1 and PGY5 years. Research can be performed as part of general rotations or as elective blocks. Residents are encouraged to present their work at provincial, national and international meetings, for which there is some funding for travel expenses by the Department.

Resident Teaching: All residents are involved in teaching undergraduate medical students, and their teaching skills are assessed by the students. There is also a component of resident teaching during the Academic Half Day and academic rounds.

Assessment of Learning

The in-training assessment program involves four (4) written examinations per year and two oral examinations. Three in-house exams are designed to mimic the Royal College examinations and they provide an excellent method of preparing for and developing comfort with the Royal College examinations. Residents also write the annual North America-wide ASCP in-service examination.

There is also a mentoring system in place whereby each junior resident is paired with a pathologist. The purpose of mentorship is to ensure educational exposure, while helping the resident with the potential stress experienced during training. Mentorship goals include building self-confidence, overcoming or circumventing communication difficulties, understanding the organizational culture and its challenges. The mentor is also present to coach the resident on how to develop consistent studying strategies, stimulate he/she to achieve their full potential, and provide guidance in career choices/paths.

With the transition to CBME, there has been the implementation a Clinical Competence Committee (CCC). The Anatomical Pathology Program Competence Committee suggests decisions related to the progression of residents through the stages of training/PGY levels in meeting the requirements for certification by the Royal College.

The CCC is chaired by an appointed faculty member. The Program Director, in discussion with the Chair of the Department, appoints members with overlapping terms to ensure continuity with renewals as defined by the departmental policies. The CCC meets at least three times year. As part of their assessment they review various evaluation tools (see below). The CCC reports outcomes of discussions and decisions to the Program Director and RPC for a final decision.

CBME and non-CBME residents are both assessed using the following tools:

Microscopic evaluations (daily)
Gross evaluations (daily)
Autopsy evaluations (daily)
Intraoperative consultation evaluations (daily)
In-service written examinations (4 times/year)
Oral examination results (2 times/year)
Research productivity
Teaching/presentation evaluations
Narrative feedback (as needed)
In-training evaluation report (end of rotation)

Quality Indicators

At the conclusion of the training period, residents achieve the skills necessary to pass the Royal College examination and perform as effective and skilled consultants in Anatomical Pathology. The program has had tremendous success in this regard, with a 100% pass rate for the Royal College examination for the past 30 years.

Regular reviews of resident rotations, faculty teaching and student experiences consistently reveal excellent evaluations. A number of our faculty have also received the Schulich Award of Excellence for Post-Graduate Education.

As well, our graduating residents have been extremely successful with respect to career placement and residents who choose to continue their training have been able to secure highly competitive fellowship positions across North America. All residents (from 2015-2019) have found fellowship or full-time staff positions after completing the Royal College examination.

Resident Publications and Awards

Please refer to **Table 7.1** for the number of AP resident publications and presentations from 2014-2019. Resident awards are listed on our website, however a few notable awards include:

Dr. Mathew Cecchini
Donald W Penner Prize, Canadian Association of Pathology
Ontario Medical Association (OMA) Resident Achievement Award
Dr. Jonathan Keow
Stowell-Orbison Award, USCAP 109th Annual Meeting
Dr. Paul Plantinga
Hugh Curry Award, Canadian Association of Pathology

Table 7.1 AP Resident Publications and Presentations (2014-2019)

	2014	2015	2016	2017	2018	2019
Manuscripts	10	4	14	6	13	4
Abstracts/Presentations	4	8	13	11	16	4

Accreditation

The Program underwent accreditation review by the Royal College in November 2019. The program received a recommended status of "Accredited program with follow-up by regular review". The final decision of the Residency Accreditation Committee with official documentation is expected in the spring of 2020.

Our 2019 accreditation documents are available upon request.

Challenges and Opportunities

Strengths of the program include our large volume of clinical cases, highly committed faculty in terms of education, support and mentoring, frequent in-training examinations and an unparalleled (in Canada) success rate at the Royal College examinations. Some challenges include relatively tight work space for residents and, temporarily, demands related to the move to CBME assessments.

7.2 Neuropathology Residency Program

The Neuropathology (NP) Residency Program continues to average approximately one (1) graduate every two (2) years as has been the case for more than 40 years. At present we have one senior resident (Dr. Basma Alyamany) who will be writing her fellowship exams when permitted, given the cancellation of spring exams due to COVID-19. Following her exam, she will be undertaking a year's fellowship in neuromuscular pathology under the supervision of Dr. Hammond beginning in July 2020. We also look forward to welcoming a new PGY1 trainee this summer. Residents from training programs in Anatomical Pathology (AP), Neurology and Neurosurgery complete elective rotations in Neuropathology, enriching the training environment for our own trainees in return.

The Residency Program underwent accreditation review by the Royal College in November 2019. The Program was happy to receive a recommended status of "Accredited program with follow-up by regular review". The final decision of the Residency Accreditation Committee is expected in the spring of 2020.

Four faculty members in NP (David Ramsay, Lee-Cyn Ang, Qi Zhang and Robert Hammond) provide supervision and training of the residents. More than 28 Anatomical Pathologists are also involved in the training of these residents, particularly during their year of compulsory training in AP. In addition, a minimum two-month rotation in Pediatric Neuropathology at the University of Toronto or the University of British is mandatory.

The majority of resident teaching occurs at University Hospital. Intraoperative consultations from Victoria Hospital are performed remotely, providing residents with experience in digital pathology. Teaching during autopsy, brain cutting, intraoperative consultations and microscopic sign-out sessions are supplemented by Academic half-days on Tuesday mornings.

Tuesday mornings begin with Clinical Neurosciences grand rounds which represent an invaluable exercise for NP residents in improving their skills in clinical-pathological correlations. These rounds also provide an interactive opportunity for NP residents with their counterparts in Neurology, Neurosurgery and Neuroradiology. These are followed by NP-specific elements including a weekly unknown slide session (including a mock examination of 5 cases), weekly NP Team rounds (where challenging cases are brought for review by all members) as well as periodic Teaching Seminars for NP residents.

For teaching in anatomical pathology, residents are required to attend Wednesday noon rounds with the AP residents where surgical biopsies are presented and the Forensic Pathology Rounds teaching where general forensic pathology is being taught. Pathology Grand Rounds and the Robert Zhong Research Seminars are held every month. Other learning opportunities open to NP residents include epilepsy, stroke, neuroradiology, and neuromuscular rounds. A monthly Neuropathology Slide Teaching Session on the CNS Academic half-day is offered for all Neuropathology, Neurology and Neurosurgery residents.

Program Description and Objectives

The goal of the Neuropathology (NP) program is to provide residents with excellent training in all areas of NP. Residents should have a good understanding of basic and clinical neurosciences as well to act as a resource in clinical practice and research. After completion of training, the residents will have the required knowledge and skills to pass the Royal College Examination and function as

competent neuropathologists. Neuropathologists should be good teachers and researchers as well as most will be employed in large academic institutions.

Program Oversight

The Neuropathology Training Program Director (Dr. Rob Hammond) and Program Committee are responsible for all administrative features of the program including planning, organizing, evaluating and optimizing the program. The Committee reports to the Program Director and supports him/her in their role. The Program Director reports to the Department Chair and the Associate Dean for Postgraduate Medical Education.

Admission Statistics

The residency program offers one (1) position per year through the Canadian Residency Matching Service (CaRMS), although not every year. From 2015-2020, these positions were filled through the first or second iterations.

Curriculum and Program Delivery

A. Educational Experience (Rotations) by Year (non-CBD)

Year	Rotations	Assessment Methods
PGY1	Pediatric Emergency (1 block) Neuropathology (1 block) Neurosurgery (1 block) Internal Medicine (2 block) Emergency Medicine Adult (1 block) Neurology (2 blocks) Gyne Oncology (1 block) Neuroradiology (1 block) General Surgery (1 block) Otolaryngology (1 block) Pediatric Neurology (1 block)	Rotation evaluations
PGY2	**Anatomical Pathology Year:** GI/Liver/Pancreas (1 block) General Pathology (1 block) Autopsy Pathology (2 blocks) Gyne Pathology (1 block) Genitourinary (1 block) Bone/Soft Tissue (1 block) Breast (1 block) Head and Neck (1 block) Molecular Pathology (1 block) Skin Path (1 block) LBL Pathology (1 block) Cytology (1 block)	Rotation evaluations • Intraoperative evaluation form • Written in-training exams • NPISE examination • Practice oral exams
PGY3-5	Neuropathology (37 blocks) Electives: Pediatric Neuropathology (2 blocks)	

PGY1: The PGY1 year is designed as broad based medical training and builds the foundation for Neuropathology training. It includes a general clinical year of an internship with rotations in Internal Medicine, Neurology, Neurosurgery, Surgery, Pediatrics, Neuroradiology, Anatomic Pathology (AP) and NP.

PGY2: The PGY2 year is spent in AP training, although at the request of individual candidates and the discretion of the NPTC this year may be postponed to PGY3. In the AP service, the NP residents have an opportunity to ground their knowledge in basic surgical and autopsy pathology and in subspecialties such as in head and neck, ophthalmic, bone, and soft tissue pathology which are relevant to the practice of neuropathology. Laboratory techniques, quality assurance, laboratory management/safety and time management are learnt through daily activities. They also participate in the AP Academic half-day, Forensic Pathology rounds and all the teaching sessions/ rounds for AP residents.

PGY3: Trainees in the NP core years work closely with the staff neuropathologists on a daily basis helping to prepare, study, diagnose and report on the surgical and autopsy material that comes to the Division. Trainees are also exposed to technical procedures that are special to NP and additional laboratory management considerations. In addition to general adult surgical and autopsy NP, residents gain cumulative exposure to neurocytology, developmental NP, perinatal and pediatric NP, forensic NP and neuromuscular pathology. Residents are required to participate and present in academic rounds and conferences.

PGY4 and PGY5: These years are an extension of the experiences begun in PGY 3 with the added benefit of elective time in areas of interest. It is usually recommended that the final 6 months be spent on NP in preparation for the fellowship examination. At the levels of PGY4 and PGY5, residents are expected to provide supervisory, teaching, and leadership roles for the more junior NP residents and off-service residents. A two-month rotation in Pediatric Neuropathology at the University of British Columbia is mandatory. Residents are required to complete short rotations in cytogenetics, molecular pathology and electron microscopy as well.

Education Program: A weekly unknown microscopic (or digital) slide session using 5 selected cases is also scheduled on every Tuesday when residents learn to derive at histopathological diagnosis on cases based on a step-by-step analysis of the histopathological findings. Attendance in the Neuroscience Grand Rounds is also part of the education program for NP residents. A large number of additional high-quality educational rounds (Neuroradiology, Neuromuscular, Stroke, Epilepsy, Surgical Pathology, Forensic Pathology, etc.) and academic half-day curricula (Anatomic Pathology, City-wide Academic half-day) are available. A teaching session with PowerPoint presentation is held monthly for all Neuroscience residents, including AP and NP. The program is enriched by the constant stream of Neurology, Neurosurgery and AP residents rotating through providing different perspectives to the subject of Neuropathology. Appraisal and critical reading of journals and research papers is acquired through participation at the Pathology Journal Club Seminar Series run by the Pathology Graduate Medical Education. PGY4/PGY5 residents participate in self-assessment, the development of personalized study plans, graduated responsibility and sitting periodic mock Royal College examinations in preparation for fellowship exams and readiness for independent practice.

Electives: Residents are given a period of up to twelve (12) months for elective rotations. Elective rotations could include Neurology, Neurosurgery, Neuro-oncology, and Pediatric Neuropathology. Residents can also opt to undertake a research elective on a project related to Neuroscience or Pathology.

Research: Residents are encouraged to participate in clinical and bench research and there exists an abundance of pathological material available for the basis of a range of projects from case reports to large collaborative studies. As noted above, research electives are also available to facilitate involvement in more substantive projects. Residents are funded to attend the CANP Annual meeting and present papers at this meeting. Residents also participate in the annual Pathology Department Research Day and Department of CNS Research Day.

Resident Teaching: All residents are involved in teaching undergraduate medical students, and their teaching skills are assessed by the students. There is also a component of resident teaching during the Academic Half Day and academic rounds.

Assessment of Learning

The objectives are organized according to the seven competencies of the CanMEDS roles from the Royal College of Physicians and Surgeons of Canada's Canadian Medical Education Directions for Specialists. This delineates a competency framework to assist future specialists in responding to challenges as health-care providers. These challenges require specialists to function in a healthcare system in a constant state of flux and increasing fiscal constraints, while still providing the best specialty care. The CanMEDS roles framework lies at the core of postgraduate medical education in Canada and its goal is to make objectives and strategies for learning explicit by consolidating and organizing them into a uniform framework that can be modeled nationally, across the medical specialty curricula. Please refer to our website for the residency program's Goals and Rotation-Specific Objectives. Assessment methods include:

In-Training Evaluation Reports: Residents are evaluated at the end of each three (3) block rotation, and at the mid-way point of rotations four (4) blocks in length or longer. Evaluations are objective based. In general, the rotation supervisor completes the form using input from all of the physicians with whom the trainee worked during the rotation, and completes evaluation report currently this is done online. The supervisor then discusses the evaluation with the resident, and the resident is asked to sign the report to acknowledge that it was reviewed with the resident. There is space on the form for any comments that the resident may wish to make. In certain cases, evaluation reports may be brought up at the next Residency Program Committee meeting for discussion. At the meeting, the resident representatives are asked to leave the room during these discussions. After this meeting, the Program Director may or may not follow-up with the resident.

Comprehensive In-Training Evaluation

Reporting of Results and Feedback: Each resident will receive his/her results for each of the sections and will also have the marked papers returned. The mean for the entire resident group will also be provided. The exam is reviewed by the coordinator. Marks are submitted to the Program Director for review and inclusion in the resident's file, and are discussed at a subsequent Residency Program Committee meeting.

Weekly Mock Examination: These mock examinations consists of five (5) cases including autopsy, neurosurgical and neuromuscular cases administrated under simulated examination conditions. Residents are given feedback on the answers in real-time (i.e. same day). The CanMEDS roles have been incorporated in the questions.

NP In-Service Examination: This is a national in-service examination for pathology residents in the United States and Canada, offered by the ASCP (American Society of Clinical Pathologists). It is held

each year in March or April and covers all areas of anatomical and clinical pathology. There are 300+ multiple choice questions covering all of neuropathology, including forensic neuropathology, immunopathology, laboratory administration, and special techniques. NP residents of all levels (except PGY5) are required to participate.

Preparation for the Fellowship Examination: A weekly series (10 weeks) of practical examinations with microscopic slides and PowerPoint presentation is instituted to prepare PGY5 residents for the fellowship examination. In addition a weekly self-assessment program (optional) with questions based the NP curriculum can be provided to residents in the email.

Quality Indicators

At the conclusion of the training period, NP residents achieve the skills necessary to pass the Royal College examination and perform as effective and skilled neuropathologists. The pass rate at first trial last in the last 10 years (2005-2014) is 5 out of 6 residents.

Regular reviews of resident rotations, faculty teaching and student experiences consistently reveal excellent evaluations.

As well, our graduating residents have been extremely successful with respect to career placement and residents who choose to continue their training have been able to secure highly competitive fellowship positions across North America. All residents (from 2015-2019) have found fellowship or full-time staff positions after completing the Royal College examination.

Resident Publications and Awards

Please refer to **Table 7.2** for the number of NP resident publications and presentations for 2014-2019. Resident awards are listed on our website, however a few notable awards include:

Table 7.2 NP Resident Publications and Presentations (2014-2019)

	2014	2015	2016	2017	2018	2019
Manuscripts	5	6	4	2	6	1
Published Abstracts	8	7	3	5	8	-

Accreditation

The Program underwent accreditation review by the Royal College in November 2019. The program received a recommended status of "Accredited program with follow-up by regular review". The final decision of the Residency Accreditation Committee with official documentation is expected in the spring of 2020.

Our 2019 accreditation documents are available upon request.

Challenges and Opportunities

Beyond the uncertainties presented by COVID-19, which are not unique to neuropathology, the greatest challenge for the NP residency program is succession planning in terms of pathologists (3.0 FTE currently, with one already partially retired). Transition to CBME also presents a potential

challenge from a technology adaptation standpoint. While online learning may need to expand, especially in the short term, this marries well with the move to digital evaluation methods. Some content has already been converted to digital and on-line teaching session for trainees are already occurring. In this regard, NP could become a national leader and in step with CBME.

7.3 Advanced Training

The Department of Pathology and Laboratory Medicine is fortunate to have been able to offer two positions per year for advanced training, for the past several years. We are one of the few programs in Canada to have been able to do this. With the large volume of case material and the quality of the faculty and general environment, PALM is able to provide a rich and nurturing environment for the enhancement of diagnostic skills and ability to carry out clinical and translational research.

Surgical Pathology Fellowship Program

The Department offers, in alternating years, one or two fellowship positions. The fellowship in Surgical Pathology is typically in one or two surgical pathology subspecialty areas. The fellow is a member of the relevant subspecialty team and carries out assigned responsibilities in surgical pathology. Approximately 75% of the fellow's time is allocated to clinical service (vs research) during which there is time and direction to improve knowledge, skills and achievements in research and in specific areas of anatomical pathology. Fellows participate in one or more independent research projects suitable for publication and there are opportunities to participate in medical student/resident teaching and to present at discipline specific seminars and rounds.

Strengths of the program include the availability of excellent teaching, the large volume of material available for learning and the pleasant and agreeable learning environment. The main issue that we face is with the availability of continued stable funding for the program. Nevertheless, Western remains one of very few sites in Canada to offer fellowship training and thus far, we have managed to continue this with funding.

Outline of recent fellowship positions and subspecialties:

2015-16: One fellow (GI, breast)
2016-17: Two fellows (GI; neuropathology)
2017-18: One fellow (GI)
2018-19: Two fellows (GU and breast; hematopathology)
2019-20: One fellow (GI)
2020-21: Two fellows (GI; hematopathology and GU)

Area of Focused Competence (AFC) Diploma in Cytopathology

The Area of Focused Competence (AFC, Diploma) program in Cytopathology was accredited by the Royal College of Physicians & Surgeons of Canada (RCPSC) in March 2014. It is the first AFC in Cytopathology in Canada and the first accredited AFC program in Laboratory Medicine apart from transfusion medicine. It has recently been recognized as a model AFC competency-based program for the RCPSC.

The AFC Diploma is a competency based program for advanced training in Cytopathology. The milestones include independent case sign-out of in-house and consultation cases, performance of rapid on-site adequacy evaluations & fine needle aspiration biopsies and participation in quality assurance activities. There is a concomitant academic program with broad topic coverage including lab administration, quality assurance, medicolegal aspects and development of teaching skills.

Our interdisciplinary team members are from Pathology and Laboratory Medicine, Otolaryngology, Imaging and Internal Medicine (Endocrinology) and include physicians and cytotechnologists. Training experiences occur at all three of the hospital sites in London, Ontario, as well as at one of our regional hospitals in Stratford, Ontario. We have successfully graduated three trainees from the program (2014, 2016, 2018).

8. Continuing Professional Development (CPD)

The Department of Pathology and Laboratory Medicine Continuing Professional Development committee coordinates a variety of general and subspecialty pathology rounds and assists in accreditation of these rounds through the Royal College of Physicians and Surgeons of Canada (RCPSC).

A. Rounds

Departmental Grand Rounds are accredited through the RCPSC and occur on a bimonthly basis during the academic year (September to June). Speakers come from a variety of centres and disciplines and have traditionally been highly rated by our attendees. We have implemented the use of videoconferencing and web casting in order that these rounds may be broadcast to surrounding community hospitals as well as to staff located in satellite offices throughout London. Additionally, "interesting case" rounds and numerous subspecialty rounds are held weekly and provide excellent learning opportunities for our residents and staff; a subset of these rounds are accredited.

Date	**Speaker**	**Title**
15-Jan-2015	Dr. C.M. McLachlin Pathology and Laboratory Medicine, Western/LHSC	Recent changes in cervical cancer screening in Canada - The 2014 Canadian Society of Cytology Kulcsar Lecture
9-Apr-2015	Dr. C. Watling Associate Dean, Postgraduate Medical Education, Schulich School of Medicine & Dentistry	Cognition, Culture, and Credibility: Deconstructing Feedback in Medical Education
17-Sep-2015	Dr. Blaise Clarke Laboratory Medicine & Pathobiology, University Health Network, Cancer Clinical Research Unit, Princess Margaret Cancer Centre	Identifying Lynch syndrome in patients with gynecologic cancers: implementation of reflex testing strategies and its implications
12-Nov-2015	Dr. Michael Silverman Medicine/Infectious Diseases, Western University	Fecal microbial Transplantation, What does this cr*p have to do with me?
14-Jan-2016	Dr. Chris Howlett, Dr. Bekim Sadikovic Pathology and Laboratory Medicine, Western/LHSC	Personalized oncology, cancer genetics and the expanding role of the pathology laboratory
14-Apr-2016	Dr. Sandrine deRibaupierre Clinical Neurological Sciences, Western/LHSC	Augmented and Virtual Reality: From teaching Neuroanatomy to training Surgeons
22-Sep-2016	Dr. Rob Hammond Pathology and Laboratory Medicine, Western/LHSC	Medical School Admissions Under the Microscope

17-Nov-2016	**Dr. Johan Delport** Pathology and Laboratory Medicine, Western/LHSC	MALDI-TOF Improves Quality of Care
12-Jan-2017	**Dr. Paul Adams** Chief of Gastroenterology, Western/LHSC	The Art of Hepatology
20-Apr-2017	CANCELLED	
21-Sep-2017	**Dr. Amanda J. Moehring** CRC in Functional Genomics, Biology, Western University	Imposter syndrome: How to keep self-doubt from sabotaging your success
9-Nov-2017	**Dr. Kathryn Roth** Otolaryngology-Head & Neck Surgery Western/LHSC	The Road to CBME: Lessons from otolaryngology
18-Jan-2018	CANCELLED	
19-Apr-2018	**Dr. David Viswanatha** Lab Co-Director, Molecular Hematopathology, Mayo Clinic Rochester	Molecular Diagnostics of Hematologic Neoplasms: Next Generation Sequencing and Next Generation Challenges
26-Sep-2019	CANCELLED	
1-Nov-2018	**Dr. Rish Pai** Laboratory Medicine and Pathology, Mayo Clinic Arizona	An Update on Lynch Syndrome Screening: Are We There Yet?
17-Jan-2019	**Dr. Javeed Sukhera** Child and Adolescent Psychiatry, Western/LHSC	Bias in the Mirror: Exploring Implicit Bias in Health Professions
16-Apr-2020	CANCELLED	
26-Sep-2019	**Dr. Rebekah Jacques** Pathology and Laboratory Medicine, Western/LHSC	The Negative Medicolegal Autopsy
7-Nov-2019	**Dr. C. Watling** Associate Dean, Postgraduate Medical Education, Schulich School of Medicine & Dentistry	Building the foundation: observation and feedback in CBME
16-Jan-2020	**Dr. Iram Siddiqui** Paediatric Laboratory Medicine, Hospital for Sick Children, Toronto	Pediatric Liver Diseases-Potpourri of Atypical Cases
16-Apr-2020	CANCELLED due to COVID-19	

B. CME Events

The Department of Pathology and Laboratory Medicine has held several well-received "Update in Pathology" CME days targeted for community pathologists and residents. These events consisted of various speakers from the Department of Pathology and Laboratory Medicine speaking on select topics in Surgical Pathology. Occasional events have included guest speakers, including Dr. Tony Piscione of the CMPA (2019) and Dr. Jason Hornick from Harvard Medical School (2014).

We have also introduced "Interactive Microscope Tutorial" CME days. These workshops, facilitated by LHSC pathologists, take place at our multi-headed microscope and are attended typically by 5-10 community pathologist attendees. The small group/interactive format has been well-received by our community pathologist colleagues.

Finally, our Department has been hosting a well-attended conference "Advances in the Practice of Cytopathology" every two years. This conference is produced in cooperation with Mount Sinai Hospital in Toronto, where the conference is hosted in alternate years. This conference has typically consisted of a keynote address by an internationally renowned expert in cytopathology (Dr. Sara Monaco [2019], Dr. Manon Auger [2017], Dr. Jeffrey Krane [2015]) as well as numerous additional lectures delivered by LHSC and Toronto-based cytopathologists. The target audience for these events, includes community cytotechnologists, cytotechnologists at LHSC or other hospitals, community pathologists, and residents.

Date	**Event**	**Host(s)**
22-Jan-2016	Interactive Microscope Tutorial in GI and Liver Pathology	PaLM (Western/LHSC)
17-Jun-2016	Interactive Microscope Tutorial in Breast and Gynecologic Pathology	PaLM (Western/LHSC)
22-Oct-2016	Bedard Symposium	PaLM (Western/LHSC) Mount Sinai Hospital, Toronto
25-Mar-2017	Update in Selected Topics in Pathology	PaLM (Western/LHSC) Cancer Care Ontario
21-Apr-2017	Interactive Microscope Tutorial in Hematopathology	PaLM (Western/LHSC)
29-Sep-2017	Interactive Microscope Tutorial in Genitourinary Pathology	PaLM (Western/LHSC)
21-Oct-2017	Advances in the Practice of Cytopathology	PaLM (Western/LHSC) Cancer Care Ontario
3-Mar 2018	AJCC 8th Edition: What's New in Cancer Reporting	PaLM (Western/LHSC) Cancer Care Ontario
16-Nov-2018	Interactive Microscope Tutorial in Skin and Soft Tissue Pathology	PaLM (Western/LHSC)
1-Dec 2018	Bedard Symposium	PaLM (Western/LHSC) Mount Sinai Hospital, Toronto
30-Mar-2019	Pathologist Consultation 101: Liability and Best Practices	PaLM (Western/LHSC) Cancer Care Ontario
26-Oct-2019	Advances in the Practice of Cytopathology	PaLM (Western/LHSC) Cancer Care Ontario

Note: Our event scheduled for May 29, 2020 (Interactive Microscope Tutorial in Head and Neck Cytopathology and Surgical Pathology) was cancelled due to COVID-19.

Challenges and Opportunities

The strengths of the CDP program include excellent attendance at events, a wide range of topics, and departmental financial support to invite external speakers to London. At times however, we have encountered issues with finding appropriate space to host our events.

Where we see opportunities however, is in reaching a wider audience through new modalities such as web-casting, establishing a routine schedule for "Update in Pathology CME" days (e.g. every two years in the spring), and developing an on-line section for three Maintenance of Certification (MOC) from the Royal College credit modules.

Finally, as with all CPD programs, the ongoing challenge exists to find topics of global interest to a diverse audience (e.g. pathologists, basic science faculty, trainees). As well, the realities of COVID-19 are upon us, and the impact and implications on our ability to host large in-person events in the future is not fully clear.

Looking Ahead

For the upcoming 2020-2021 academic year we are continuing with Pathology Grand Rounds every other month (alternating with the Dr. R. Zhong lecture series). We will have a variety of speakers scheduled, both internal and external. We hope to host at least one "Interactive Microscope Tutorial" in the fall of 2020, and an "Update in Pathology" CME event in the spring of 2021.

9. Research

The Department of Pathology and Laboratory Medicine occupies a unique position at the Schulich School of Medicine & Dentistry by spanning both clinical and basic sciences. Most department members have clinical responsibilities at London Health Sciences Centre (LHSC; University Hospital, Victoria Hospital), and teaching duties in the undergraduate and postgraduate medical education programs. Some of our faculty members concentrate on basic science research and a few that do both, clinical and basic sciences. We have maintained our excellent research productivity, in both basic and clinical sciences, over the past five years – this, despite external funding challenges. We expect to enhance and further grow our research capacity and productivity as we have been able to recruit new scientists to strengthen our research efforts. We have also continued to explore cross-appointments of strong researchers in our department and to build a multidisciplinary approach to research.

Major enhancements/achievements over the past 5 years:

- ☑ Recruitment of Beryl Ivey Endowed Research Chair in One Health
- ☑ Recruitment of a Veterinary Pathologist
- ☑ Recruitment of multiple basic scientists and clinician-scientists
- ☑ Continued growth of cross-appointed scientists actively contributing to research and educational activities of the Department
- ☑ Enhancements to the Pathology and Laboratory Medicine Research Day (marquee event)
- ☑ Launch of the annual Paterson Lectureship (3 Nobel Laureates delivered the Paterson Lecture at Western University)

Scope of our Research

The Department of Pathology and Laboratory Medicine is an integral part of the vibrant Western research enterprise. Our faculty members have expertise in a broad array of basic, translational, and clinical research. Areas of research, where we excel, include cardiovascular biology, cancer biology, immunology/inflammation, neuropathology, regenerative medicine, and computational biology. In the past few years, we have seen diversification of our research expertise through new appointments and recruitments. We have added new research expertise to our repertoire, while strengthening the established ones.

Our members have continued to excel in their respective research programs, which are in perfect alignment with Schulich Medicine & Dentistry *areas of research excellence*. Highlighted in **Table 9.2** are a few specific research programs in which Pathology and Laboratory Medicine plays a major role. Research is a broad term and encompasses all types of new knowledge creation. We have loosely categorized our research activities into two general types: clinical and basic. In these tables, clinical research is defined as interventional and/or observational studies involving participants, quality assurance studies, and diagnostic testing studies. Basic research is defined as fundamental science, conducted to increase the understanding of the mechanisms of human health and disease.

Table 9.2: Research Activities and Expertise in Pathology and Laboratory Medicine

A. Cancer Biology			
Researchers	Areas of Research	Clinical science	Basic science
Ainsworth, P.	cancer genetics	☒	☒
Ang, LC.	brain cancer	☒	☐
Chakrabarti, S.	skin, liver cancers	☒	☒
Chan, N.	gynecologic cancers	☒	☐
Darling, M.	oral cancers	☒	☐
Dick, F.	cancer genetics	☐	☒
Dong, C. [Dentistry]	oral cancers	☒	☐
Driman, D.	gastrointestinal	☒	☐
Ettler, H.	gynecologic, breast	☒	☐
Gabril, M.	skin, prostate cancer	☒	☐
Goebel, E.	gynecologic cancers	☒	☐
Gomez-Lemus, J.	breast, genitourinary	☒	☐
Haig, A.	renal, gynecologic cancers	☒	☐
Hammond, R.	brain tumours	☒	☐
Howlett, C.	hematopathology, gastrointestinal, genetic cancers	☒	☒
Joseph, M.	skin cancers	☒	☐
Khan, Z.	ovarian cancer, soft tissue tumours	☐	☒
Lin, X.	cancer genetics	☒	☐
Maleki, S. [Oncology]	skin, renal, lung cancers	☒	☒
McCord, C.	oral cancers	☒	☐
McLachlin, M.	gynecologic cancers	☒	☐
Moussa, M.	genitourinary pathology	☒	☐
Parfitt, J.	gastrointestinal cancers	☒	☐
Sangle, N.	hematopathology	☒	☐
Thang, T. [Dentistry]	oral cancers	☒	☐
Walsh, J.	gastrointestinal, gynecologic cancers	☒	☐
Wehrli, B.	soft tissue cancers	☒	☐
Weir, M.	gynecologic cancers	☒	☐
Zeman-Pocrnich, C.	breast, lung cancers	☒	☐
Zhang, Q.	brain tumours	☒	☒

B. Cardiovascular, Respiratory Health, and Metabolic Diseases			
Researchers	Areas of Research	Clinical science	Basic science
Arany, E.	diabetes	☐	☒
Cameron, L.	respiratory health, asthma	☐	☒
Chakrabarti, S.	diabetes, vascular biology	☒	☒
Dhanvantari, S. [Med Bio]	diabetes	☐	☒
Feng, B.	diabetes, vascular biology	☐	☒
Frisbee, S.	cardiovascular health and disease	☐	☒
Hammond, R.	vascular biology of dementia	☒	☒
Hutnik,C. [Ophthalmology]	diabetes	☒	☒
Khan, Z.	diabetes, vascular biology	☐	☒

Peng, T. [Medicine]	diabetes	☐	☒
Solh, Z.	transfusion medicine	☒	☐

C. Transplant Pathology and Immunopathology			
Researchers	**Areas of Research**	**Clinical science**	**Basic science**
Bhattacharjee, R. [Surgery]	transplant immunity	☐	☒
Cameron, L.	asthma, allergic disease	☐	☒
Jacques, R.	transplant pathology	☒	☐
Maleki, S. [Oncology]	immune-oncology	☒	☒
Min, WP. [Surgery]	transplant immunology	☐	☒
Poon, A.	virus evolution	☐	☒
Sidahmed, A.	transplant immunology	☒	☐
Zhang, ZX. [Medicine]	transplant immunology	☐	☒
Zheng, X. [Surgery]	transplant immunology	☐	☒

D. Genomics and Bioinformatics			
Researchers	**Areas of Research**	**Clinical science**	**Basic science**
Poon, A.	bioinformatics, virus evolution	☐	☒
Sadikovic, B.	molecular genetics, cytogenetics, bioinformatics	☒	☒
Shooshtari, P.	bioinformatics, computational genomics	☐	☒
Yang, P.	genomics	☒	☒
Ainsworth, P.	cancer genetics	☒	☒

E. Neuropathology			
Researchers	**Areas of Research**	**Clinical science**	**Basic science**
Duennwald, M.	neurodegenerative diseases	☐	☒
Strong, M. [Neurology]	neurodegenerative diseases	☒	☒
Zhang, Q.	neurodegenerative diseases	☒	☒
Ang, L-C.	brain cancer	☒	☐
Hammond, R.	vascular biology of dementia	☒	☐

F. One Health			
Researchers	**Areas of Research**	**Clinical science**	**Basic science**
Cabrera, A.	infectious diseases	☐	☐
Delport, J.	infectious diseases	☒	☐
Frisbee, S.	cardiovascular health	☐	☒
Fuller, J.	infectious diseases	☒	☐
Elsayed, S.	infectious diseases	☒	☐
McKinley, G.	social determinants	☐	☒
Olea-Popelka, F.	epidemiology, veterinary medicine	☐	☒
Wylie, L.	health systems	☐	☒

F. Forensic Pathology			
Researchers	Areas of Research	Clinical science	Basic science
Shkrum, M.	forensic pathology	☒	☐
Tugaleva, E.	forensic pathology	☒	☐
Jacques, R.	forensic pathology	☒	☐

Recent Research Highlights:

A. Growth of the Research Programs

The Department has made major inroads in its plans to enhance our research capacity, capability, productivity and impact. To that effect, the Department has been able to build an enhanced faculty complement, both basic and clinical. Since 2015, we have been successful in the recruitment of the Beryl Ivey Endowed Research Chair in One Health (Dr. Francisco Olea-Popelka), a veterinary pathologist (Dr. Patti Kiser), a transplant immunologist (Dr. Abubaker Sidahmed) and many basic- and clinician-scientists (Drs. Art Poon, Stephanie Frisbee, Frederick Dick, Parisa Shooshtari, Qi Zhang, Bekim Sadikovic, and Christina McCord). We have also been successful in securing a tenure-track faculty position in the cardiovascular 'omics research area. The announcement and call will be made shortly, with the anticipated start date of September 2020.

In addition to the wonderful growth of tenure-track faculty complement, we have strengthened our research activities by continually growing cross-appointed scientists actively contributing to research and educational activities of the Department. These include Drs. Rabindra Bhattacharjee, Saman Maleki, Trevor Thang, and Cecilia Dong.

B. EpiSign-CAN

A clinical trial named "EpiSign-CAN," led by Dr. Bekim Sadikovic has been awarded $4.8 million to measure the clinical impact of a new molecular genomics test for diagnosing genetic neuro-developmental conditions. The diagnostic test, called EpiSign, uses machine learning to analyze the EpiSign Knowledge Database. This database compiles information on rare genetic diseases using laboratory analyses of the entire genome, referred to as the epigenome, from patients with suspected genetic abnormalities. Dr. Sadikovic and his research has been recently profiled on Lawson Health Research Institute news and The London Free Press.

C. Establishing One Health Research

Beginning in 2015, we performed an extensive asset mapping in the Department as well as across Western. We identified *One Health* as an emerging field of research that is both beneficial to our researchers and trainees. One Health is a collaborative concept recognizing that the health of humans is inextricably connected to the health of animals and the environment. Many emerging human diseases are linked to increasing contact between humans and animals, and environmental changes brought about by urbanization, globalization, and climate change. With an increasing human population and the expansion of our social environment, there are increased pathways for disease to travel between animals and humans (for example, rabies, salmonella, newly emerging strains of flu, vector-spread diseases such as Zika). In addition, changes to the climate and land use (for example, deforestation and intensive farming) disrupt the environment and compromise habitats again providing new opportunities for diseases to be passed between animals and humans. Social and economic factors create social gradients and contribute to health inequities in

society. These inequities are often caused by unequal access to health care and are determined by factors such as income, education, culture, and lack of social support systems that can manifest in marked differences in life expectancies and disease susceptibility within a society. Thus, to really understand and achieve optimal human health and provide training to future leaders of, and in, Canadian health care, we have introduced an interdisciplinary field of research in One Health within their undergraduate (2016) and graduate (2018) training programs. Both programs have seen rapid growth and we are anticipating 10 undergraduate thesis students and 4 graduate MSc students in Fall 2020.

One Health is being received extremely well across Western. The network of researchers involved is rapidly growing. In addition, trainees have also established a One Health facebook group and the Western One Health Club. Further growth of the research field is dependent on funding support to build momentum. We have been able to secure some funds and to establish the One Health Research Award. As we look to the future, we hope to apply to external agencies to strengthen the research field which may include NSERC Collaborative Research and Training Experience Program, Canadian Institutes of Health Research – Training Grants, Grand Challenges Canada, International Development Research Centre, Public Health Agency of Canada, Public Health Ontario, and Mitacs.

Publications

Our researchers have maintained an excellent level of research productivity and have continued to publish in high impact journal articles (**Table 9.3**). Detailed publications are available on Pathology and Laboratory Medicine website (Publications).

Table 9.3: Summary of Research Publications

	2014	2015	2016	2017	2018	2019	2020 [b]
Total Publications [a]	79	90	119	136	151	154	59

[a] *Publication number indicates peer-reviewed journal publications and do not include abstracts, proceeding reports, and book chapters. Data was obtained from search engines (e.g. Scopus, PubMed) using an affiliation filter. Some publications in which affiliations are not indicated for all authors may not be captured.*

[b] *Data for 2020 only includes publications from January - March 2020 (3 months).*

Grant Funding

Our members have continuously been successful in securing external funding. Over the past few years, we have seen a steady growth in total grant funding awarded to Pathology and Laboratory Medicine researchers (**Tables 9.4 and 9.5**). Our members are also heavily involved in collaborative research. Moving forward, we need to capitalize on the critical mass of excellent researchers in the department, as well as across Western, to create new collaborations and adapt to the changing research ecosystem. A full listing of grant funding is available and will be provided upon request.

Table 9.4: Research Funding for Members in Pathology and Laboratory Medicine

Year	Externally Funded (PI)	Externally Funded (Co-I)	Internally Funded (PI)	Internally Funded (Co-I)	Total Grant Funding
>2020 [a]	$5,683,218	$1,310,051	$160,450	-	**$7,153,719**
2020 [b]	$2,256,243	$529,655	$228,494	-	**$3,014,392**
2019	$1,414,306	$721,051	$169,425	$25,000	**$2,329,782**
2018	$1,938,287	$480,084	$119,921	$37,551	**$2,575,843**
2017	$2,856,595	$280,674	$457,800	$48,596	**$3,643,665**
2016	$1,314,196	$280,674	$419,004	$197,110	**$2,210,984**
2015	$979,906	$434,485	$132,688	$40,000	**$1,587,079**
2014	$896,686	$594,008	$279,714	-	**$1,819,208**

[a] *Funds already committed to researchers beyond 2020 (multi-year grants) as of April 2020.*
[b] *Funds committed to Pathology and Laboratory Medicine researchers for 2020 (as of April 2020).*

Table 9.5: Number of Awards for Members in Pathology and Laboratory Medicine

Year	Externally Funded (PI)	Externally Funded (Co-I)	Internally Funded (PI)	Internally Funded (Co-I)	Total Grant Funding
>2020 [a]	13	3	2	-	**18**
2020 [b]	20	3	8	-	**30**
2019	30	7	7	1	**45**
2018	36	3	6	1	**46**
2017	33	2	13	1	**49**
2016	21	2	12	6	**41**
2015	16	4	10	2	**32**
2014	17	7	12	-	**36**

[a] *Number of awards already committed to researchers beyond 2020 (multi-year grants) as of April 2020.*
[b] *Number of awards won by Pathology and Laboratory Medicine researchers in 2020 (as of April 2020).*

Research Committee

Research Committee is an advisory committee to the Chair/Chief of the Department of Pathology and Laboratory Medicine. The committee is comprised of the Director of Research, two basic scientists, two clinical scientists, an Oral Pathology representative, Beryl Ivey Chair in One Health, a graduate student representative and one Pathology Resident. The Chair/Chief and Department t Manager also serve on the committee.

The Research Committee works to promote and facilitate basic, clinical and translational research in Pathology and Laboratory Medicine and affiliated hospitals. This committee advises the Chair with regards to research resources (human, infrastructure, others), research environment (physical and intellectual) and strategic planning with respect to research. The committee also plans and organizes departmental research seminars (Dr. Robert Zhong Seminar Series, Paterson Lectures, and other External/Special Seminars) and the Annual Pathology and Laboratory Medicine Research Day.

Seminar Series

The Department of Pathology and Laboratory Medicine Research Committee initiated a research seminar, named after Dr. Robert Zhong, with the purpose of capturing the research interests of our department and the wider university and hospital community. The objectives are to enhance our departmental basic and clinical science research, and to improve communication within the department and between departmental members and other researchers in the city. The Research Committee invites high profile speakers from Western to enhance our research profile and to help establish collaborations. Seminars are accredited by the Royal College Maintenance of Certification (MOC) program. Table 9.6 lists the invited speakers.

Table 9.6: Research Seminars and Speakers

Date	Speaker	Topic
2020-02-13	Dr. Michael Laposata Department of Pathology, University of Texas Medical Branch	"Medical Errors: A Major Cause of Death Across the World."
2019-11-07	Dr. John Lewis Department of Oncology, University of Alberta	"Cancer metastasis: efforts to halt the deadly progression of solid tumours."
2019-10-24	Dr. Frederick Dick Pathology and Laboratory Medicine, Western University	"Non-canonical roles for the Retinoblastoma gene in cancer biology."
2019-02-21	Dr. Francisco Olea-Popelka Beryl Ivey Chair in One Health, Pathology and Laboratory Medicine, Western University	"One Health in action: tackling health challenges at the human, livestock, wildlife interface."
2018-10-18	Dr. Stephen Barr Microbiology and Immunology, Western University	"Evolution of an ancient antiviral defence against HIV and Ebola virus."
2018-02-22	Dr. Dan Hardy Physiology and Pharmacology, Western University	"Maternal drugs in pregnancy and long-term dysmetabolism in the offspring: are there common links?"

2017-10-19	**Dr. Cheryle Seguin** Physiology and Pharmacology, Western University	"From development to disease: Lessons learned using mouse models to study the intervertebral disc."
2017-02-23	**Dr. Tim Regnault** Obstetrics and Gynaecology, Physiology and Pharmacology, Western University	"Non-communicable diseases (NCDs), a legacy of an adverse in utero environment?"
2016-12-15	**Dr. Charles Weijer** Philosophy, Medicine, and Epidemiology and Biostatistics, Western University	"Consciousness unbound: The ethics of neuroimaging after severe brain injury."
2016-10-13	**Dr. Art Poon** Pathology and Laboratory Medicine, Western University	"Examining recent virus epidemics under the lens of phylogenetics."
2016-05-12	**Dr. Andrew Nelson** Anthropology, Western University	"Paleopathology - pathology; the ancient - modern interface as experienced in the analysis of human remains from the Inca period site of Farfán Peru?"
2016-02-11	**Dr. Eric Arts** Microbiology and Immunology, Western University	"Interplay between HIV-1 and the host immune response."
2015-12-10	**Dr. Nathalie Berube** Biochemistry, Western University	"Chromatin structure dysregulation in the CNS: causes and consequences."
2015-10-15	**Dr. Subrata Chakrabarti** Pathology and Laboratory Medicine, Western University	"Diabetic complications: a journey beyond genes."
2015-02-12	**Dr. John Capone** Vice-President (Research), Western University	"Research at Western; Achieving Excellence on the World Stage."
2014-10-09	**Dr. David Litchfield** Biochemistry, Western University	"Convergence of protein kinase and caspase signaling: a mechanism for pathological rewiring of signaling pathways?"
2014-06-12	**Dr. Shiva Singh** Biology, Western University	"Genetic and epigenetic insights in neurodevelopmental disorders."
2014-03-13	**Dr. Robert Cumming** Biology, Western University	"Exploring the relationship between cancer-like metabolism and brain function in Alzheimer's disease."

Pathology and Laboratory Medicine Research Day

Pathology and Laboratory Medicine Research Day is an event organized to recognize research excellence and promote inter- and intra-departmental collaboration. This full-day event allows our trainees to present their research in oral presentations and poster sessions. Our trainees in various programs including undergraduate Bachelor of Medical Science programs, thesis-based graduate studies, professional graduate program, dual Oral and Maxillofacial Surgery MSc program, and Pathology postgraduate programs (**Table 9.7**) showcase their research work, receive feedback, and

learn. We also invite external researchers to deliver the keynote address (**Table 9.8**) and award a number of research awards to recognize our trainees (**Table 9.9**). For a list of research day awards, please see Pathology and Laboratory Medicine Research Day webpage. Over the years, we have seen an excellent level of participation at this event, in alignment with the growth of our research training programs. The Research Committee continuously reviews the format and makes changes to make this important day as effective and enjoyable as possible.

Table 9.7: Research Presentations at Pathology and Laboratory Medicine Research Day

	2014	2015	2016	2017	2018	2019	2020*
BMSc Students	15	14	12	19	20	19	21
Graduate Trainees	33	36	41	36	44	37	34
Postdoctoral Fellows	-	-	-	4	6	4	2
Pathology Residents	7	10	9	9	10	8	8
Other (e.g. visiting students)	-	-	-	3	4	11	8
Total Abstracts	**55**	**60**	**62**	**71**	**84**	**79**	**73**

**2020 Research Day postponed due to COVID-19-related University closure.*

Table 9.8: Keynote Address and Speakers at Pathology and Laboratory Medicine Research Day

Year	Keynote Speaker	Topic
2019	**Dr. Anthony Magliocco** Senior Member and Chair Department of Anatomic Pathology Moffitt Cancer Center, Florida	"Reimagining pathology in a Precision Oncology World: A vision for the Road Ahead"
2018	**Dr. Harold Atkins** Scientist Cancer Therapeutics Program Ottawa Hospital Research Institute	"Regenerative Medicine of the immune system: Harnessing stem cell transplantation for autoimmune diseases of the nervous system and beyond"
2017	Cancelled *Speaker unable to travel due to medical reasons*	N/A
2016	*Keynote coupled with Paterson Lecture in 2016*	*Please see 2016 Paterson Lecture, section 9.9 below*
2015	**Dr. Nahum Sonnenberg** James McGill Professor Department of Biochemistry McGill University	"Translational control in cancer and autism"
2014	**Dr. Tom Hudson** President and Scientific Director Ontario Institute for Cancer Research	"Genome Variation & Personalized Cancer Medicine"

Table 9.9: Awards Presented at our Annual Pathology and Laboratory Medicine Research Day

Recipient	Award
Pathology Postgraduate Residency	**Chair's Award for the Best Presentation by a Resident** This award recognizes a Pathology Resident's excellence in research design and performance, as well as the presentation of the research topic. **Best Clinical Science Poster Presentation Award** This award recognizes a Pathology Resident's excellence in research design and performance, as well as the presentation of the poster.
Graduate Trainees	**Dr. M. Daria Haust Award for the Best Basic Science Presentation** This award recognizes a graduate student's excellence in research design and performance, as well as the presentation of the research topic. This award is given in recognition of Dr. M. Daria Haust's many achievements in the Department of Pathology at the University of Western Ontario and London Health Sciences Centre. **Best Basic Science Poster Presentation Award** This award recognizes a Graduate Student's excellence in research design and performance, as well as the presentation of the poster. **Best Basic/Clinical Science Collaborative Poster Presentation** This award recognizes excellence in research design and performance as well as the presentation of a research poster. This award is given to a Graduate Student or a Pathology Resident to recognize collaborative basic and clinical science research. **Best Poster Presentation by a Pathologists' Assistant Graduate Student** This award recognizes the best poster presentation by a Graduate Student in the Master of Clinical Science Pathologists' Assistant Program.
Postdoctoral Fellow (Research)	**Best Presentation by a Postdoctoral Fellow/Scholar** This award recognizes excellence in research design and performance as well as presentation of a research poster by a postdoctoral fellow or scholar in Pathology and Laboratory Medicine.
Undergraduate BMSc Trainee	**Best Undergraduate Basic Science Poster Presentation** This award recognizes excellence in research design and performance as well as presentation of a research poster by an undergraduate student in Pathology modules of the Bachelor of Medical Science program.

Paterson Lecture

This lecture series was established in honor of Dr. James Paterson, who was a Professor in the Department of Pathology at Western. He was an internationally recognized researcher in the field of atherosclerosis and vascular disease. He had a profound impact on many students, particularly in stimulating interest in medical research. Together with John Fisher, Dr. Paterson established our research programs leading to MSc and PhD degrees. The Paterson Lectureship, entitled 'Discover, Share, Inspire' was established in his memory (details available on our Paterson Lecture website). We have invited world-renowned researchers to deliver the Paterson Lecture (**Table 9.10**). These lectures have been attended by hundreds of participants each year and have raised the profile of Pathology and Laboratory Medicine at Western.

Table 9.10: Paterson Lecture Invitees

Year	Invited Speaker	Topic
2019	**Dr. Jeffrey V. Ravetch** Theresa and Eugene M. Lang Professor Immunology, Virology, and Microbiology Director, Cooperative Center for Human Immunology Rockefeller University	"Enhancing Immunity through Fc Receptors."
2018	**Dr. Randy Schekman** Recipient of the 2013 Nobel Prize in Physiology or Medicine Professor, Cell and Developmental Biology University of California, Berkeley	"RNA binding proteins and RNA sorting signals required to package small RNAs into exosomes secreted by human cells."
2017	**Dr. Martin Chalfie** Recipient of the 2008 Nobel Prize in Chemistry Professor, Department of Biological Sciences Columbia University	"Guarantor Transcription Factors in Cell Differentiation."
2016	**Dr. Andrew Fire** Recipient of the 2006 Nobel Prize in Physiology or Medicine Professor, Pathology and Genetics Stanford University School of Medicine	"Biological responses to foreign information."

Space

The Department of Pathology and Laboratory Medicine continues to be in urgent need of research space. The volume and quality of the research space in the Dental Sciences Building (DSB) is a critical issue and severely impacts our ability to attract new faculty and to perform research activity efficiently and in a collaborative manner. We hope to renovate the 4th floor DSB for future scientist recruitment and to enhance our research activities. Some investigators in our department are unable to accept more students simply because of a lack of physical space for research and not because of limited funding issues.

Core Facilities

The department continues to provide a significant amount of research infrastructure to its basic and clinical scientists, graduate and undergraduate students and Pathology Residents. These resources are organized as core facilities at London Health Sciences Centre (LHSC) or Western to facilitate research of our investigators. A full listing and description of our core facilities is available on our website. In brief, the core facilities include:

- Aperio Glass Slide Scanner
- Kodachrome Slide Scanning
- Autoclave Facility
- Brain Tumour Tissue Bank
- Confocal Facility
- Cryo-Sectioning Laboratory
- Experimental Transplant Pathology Laboratory
- Laser Dissection Facility
- Microscopic Image Analysis Facility

- Poster Preparation & Printing / Multimedia Facility
- Real time quantitative PCR Facility, including automated RNA isolation facility

In addition to equipment available as core facility, our basic science investigators have functional laboratories, equipped with cell culture facilities, biochemistry and molecular biology equipment, and imaging instruments. These are also available to our researchers and trainees.

Challenges and Further Opportunities for Research Enhancements

We have taken major steps to implement our departmental 2014-2019 Strategic Plan in terms of research activities. The plan largely focused on enhancing our awareness of research activities and successes in the department and enhancing the research profile of the department. To achieve these goals, we have enhanced our communication of research success by faculty and trainees in the monthly PaLM Post, featured stories on our website, and Annual reports. As mentioned above, we have also increased our efforts to invite high-profile researchers to deliver the Paterson Lecture and the keynote address at our Annual Pathology and Laboratory Medicine Research Day.

Survey of our research landscape has identified two emerging areas for improvement: 1) enhancing our research funding success, and 2) updating/renovating research space.

Challenge 1: Research Funding

As we all know, the research funding environment has undergone major changes in the past few years. Two mechanistic changes in research funding have really challenged researchers at all career stages. First, granting agencies (CIHR, NSERC and SSHRC) have not kept pace with the significant increase in the number of research faculty as well as enhanced pressure to increase enrolment in research trainees. Second, we have seen a shift by the funding agencies towards research that is more collaborative in nature and one that demonstrates a direct economic impact. So far, we have been able to maintain our research activities through recruitment of new faculty, granting of cross-appointment of strong scientists from other departments, and establishing collaborations within and outside of our department. To increase the likelihood of research funding success, we plan to identify clusters of research excellence and nominate a research node leader for each cluster, as identified in our 2018-2023 Strategic Plan. This will allow us to leverage departmental assets and expertise and identify areas where Pathology and Laboratory Medicine can excel.

Challenge 2: Research Space

Inadequate research space, especially at Western campus, has hindered our research activities. Space is not only critical for the recruitment of new faculty with strong research programs but also for enhanced collaboration among researchers situated on campus. Without funding support to renovate the space, our research growth will certainly be limited. We continue to advocate for improvement and apply for funding when such opportunities present. We hope that soon we will not have to identify research space as a challenge.

10. Clinical Service

10.1 Program of Pathology

A. Outline of the Program and Ability to Meet Its Clinical Demands

The Program of Pathology includes the Divisions of Surgical Pathology, Cytopathology, Autopsy as well as Microbiology (Micro) and Molecular Diagnostics (MolDx). The integration of these five divisions under a single program is based on common approaches and emerging testing methods. The collaboration between the tissue-based services and MolDx continues to increase with integration of morphology and DNA based diagnostics. Microbiology is more and more relying on molecular based methods for identification, especially of viral diseases. The growing partnership between MolDx and Micro was recently strengthened during the rapid development of testing for the COVID-19 virus required during the pandemic. All five divisions have a dynamic partnership of professional (Division Head) and administrative (Coordinator) leads that work together to ensure timely and accurate diagnoses.

The tissue-based services of Surgical Pathology, Cytopathology and Autopsy are provided at University Hospital while MolDx and Micro are situated at Victoria Hospital. Providing services across 3 campuses (UH, VH, SJHC) requires daily coverage by both professional and technical staff as well as a regular and reliable transportation system. Pathologists are available at all 3 sites for intraoperative consultations that are critical for surgeons to make decisions while operating. Samples are shipped between campuses to optimize testing platforms. Communication and interaction between staff require effective use of email, teleconferencing and videoconferencing. This communication is supported by videoconferencing however, improved platforms and hardware are needed to optimize online communication.

The Divisions all face similar challenges, mainly related to increasing volumes and complexity of specimens. These challenges surface with lengthened turnaround times (TATs) and are the result of both limitations to staffing and equipment. Our professional staff are highly skilled but adding medical positions is limited by the Ministry of Health funding models. The ability to hire and retain technical staff has been particularly challenging and reflects an aging demographic in our current staff. Constraints on capital equipment purchases have often required that the Divisions deal with an increasing workload without the benefit of optimal testing platforms.

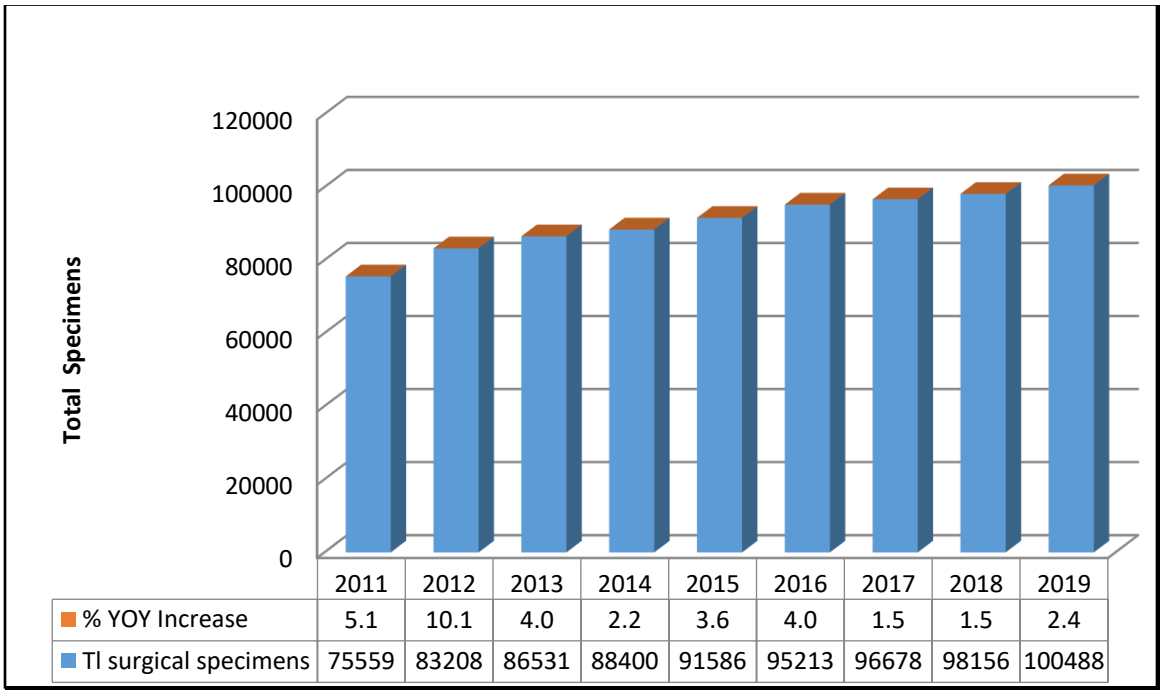
B. Quality and Relevance of Pathology Services

Division of Surgical Pathology

Surgical Pathology Diagnostics are provided by teams of pathologists with specific training/interest in their subspecialty areas. The pathologists participate in clinical care teams throughout the hospital. For example, pathologists are active members of Diagnostic Site Teams for the Regional Cancer Program.

The volume of surgical pathology specimens (specimen refers to each separately submitted tissue within a case e.g. a single case may include 3 GI biopsy specimens) has steadily increased over time (**Figure 1**).

Figure 1: Surgical Specimens Received Annually



	2011	2012	2013	2014	2015	2016	2017	2018	2019
% YOY Increase	5.1	10.1	4.0	2.2	3.6	4.0	1.5	1.5	2.4
Tl surgical specimens	75559	83208	86531	88400	91586	95213	96678	98156	100488

This increase has occurred most notably in GI specimens, mainly related to colon cancer screening and treatment. As well, the complexity of reporting requirements and ancillary testing methods have added to per case workload. It is a constant struggle to maintain TATs due to volume and resource issues. The largest delays in TAT are in specimen grossing and processing and slowdowns in these areas are directly related to insufficient technical staff that are available to process specimens. Currently, the pathologists maintain appropriate TATs once the case is processed but it is likely that any increase to work volume would shift that balance as well. These delays result in pressure from the clinical services as well as from governmental agencies such as Cancer Care Ontario. Our department is frequently unable to meet CCO's recommendation that at least 85% of cancer cases be reported within 14 days. Significant effort is being put into finding efficiencies but until human resource issues are stabilized the situation is likely to continue.

In recent years the reporting of pathology specimens has extended to molecular/predictive biomarkers for many cancer types. Our Department has implemented integrated testing for all biomarkers recommended by CCO. This has required the development of detailed workflow to ensure that the appropriate tissues and reports are created in partnership with the MolDx division. Undoubtedly the Divisions of Surgical Pathology and Molecular Diagnostics will continue to work closely to align diagnostic processes to support personalized medicine. The need to up to date testing platforms and appropriate staffing will be required to ensure optimal testing for patients.

Division of Cytopathology

Overview of the Diagnostic Service: Our cytopathology division is committed to providing timely and accurate diagnostic service to our patients; we have highly qualified professional and technical staff. Over the years, we have experienced a reduction in Gyn volume, but our Non-Gyn volume is steadily increasing. Our cytotechs continue to provide a highly regarded FNABs-ROSE service (Rapid On-Site Evaluation, 1294 cases in 2019 alone) to clinicians. We have a robust Quality Management

program in place. We have successfully integrated cytopathology and molecular diagnostics into our FNAB service which allows clinicians to initiate newer targeted therapies for cancer patients. We provide expert cytopathology service to most regional hospitals in Southwestern Ontario (Stratford, Chatham, St. Thomas, Woodstock, Tillsonburg, Strathroy, and Ingersoll). Physician and administrative level engagement on both sides is high; our senior team members facilitate/conduct periodic partnership meetings with regional centres via site visits or through teleconferences.

Staffing and Service Volume:

Senior Cytotechnologist, 7 cytotechnologists (MLTs), 1.5 FTE Medical Lab Assistants (MLAs) and 6 Pathologists of which 5 are Cytopathologists.

In 2019, we received 20779 cytology cases of which 12560 were Non-Gyn and 8219 Gyn cases. Out of 3237 FNABs, there were 447 EBUS and 315 EUS complex cases. The Non-GYN volumes increase every year.

Strengths:

Education is a major thrust of our division. Our team is dedicated to training Michener Cytotech students, medical students, residents/fellows and visiting pathologists. We provide a hands on FNAB demonstration session to our Med3 clerkship students. We run every 2 years the RCPSC accredited "Area of Focused Competence" Cytology Diploma Program for Royal college certified pathologists. We provide many in-house cytopathology educational rounds including technical and professional staff, residents and clinicians (e.g. Monthly cytology rounds and EUS rounds) to enhance team relationships. In addition, every 2 years, we organize a Cytopathology CME event in London for provincial pathologists and technologists; last one was held on October 26, 2019.

Implementing ongoing Quality Improvement initiatives is a major priority for our division. We completed several QI research projects in the division during the past 5 years. We are pleased to state that our team members received the Hugh Curry CAP conference award for a Biliary Brush QI project (2018) and a Urine Cytology QI project (2019). Last year, we successfully implemented an HPV testing protocol for GYN samples in collaboration with our clinicians and LifeLabs.

Opportunities and Challenges:

The scope of cytopathology practice is growing steadily with complex procedures such as EUS and EBUS FNABs. This complexity demands defined core competencies and training for pathologists and cytotechnologists to function in a specialized cytopathology laboratory. Maintaining ongoing education and recruiting highly qualified staff are much needed in our practice.

Regional expansion of our cytopathology service created new opportunities and challenges which include more day to day problem solving and a need to build stronger team relationships with partners. In order to strengthen our community partnership, we have initiated a few focused in-service education sessions to external medical staff and conducted periodic partnership meetings with administrators in regional centres. Our recent CCO sponsored in-service on thyroid FNAB to external medical staff on January 19, 2020 was well received. Overall, we are pleased with the progress we have made over the past 5 years. In future, as opportunity arise, we have the strength and resources to further expand our cytopathology diagnostic service to those in need in the region and beyond.

Division of Autopsy

The autopsy service based at University Hospital serves a dual role. By doing autopsies authorized by families of individuals dying in hospital, it monitors quality assurance of clinical services at LHSC. As the Southwestern Ontario Regional Forensic Pathology Unit of the Ontario Forensic Pathology Service, the service performs medicolegal autopsies for a geographic area which extends roughly from Windsor to Woodstock to Tobermory.

From 2014 to 2019, the total caseload, including both hospital consent and coroner's autopsies, increased 7.5%, from 668 to 716.

The forensic caseload has steadily increased as the provision of forensic pathology services has been reduced in community hospitals throughout the region, necessitating referral of cases to London. From 2015 to 2018, the increase was 20%, from 470 to 565 coroner's autopsies. Case numbers are anticipated to continue to increase with population growth, the persistent rise in opioid-related deaths and potential further closure of regional autopsy services. A recent challenge has been to adapt procedures yet continue the provision of the autopsy service during the COVID-19 pandemic. The Division was able to quickly and efficiently develop and implement a plan for possible increases to autopsy and body storage needs in case of a possible surge in COVID cases.

The forensic service has benefitted from the addition of Dr. Jacques, joining the other 3 forensic pathologists, namely Drs. Tweedie, Shkrum, and Tugaleva. Our forensic pathologists are focused on autopsy pathology and provide service coverage. The team receives valuable neuropathology consultation assistance from the LHSC neuropathologists as well as service support from 4 surgical pathologists.

Related activities include court witness appearances, medico-legal consultation work, and forensic teaching at the undergraduate and graduate level, as well as outreach teaching including police training.

Research initiatives are ongoing, focusing on motor vehicle-related trauma, and forensic medicine ethics.

Division of Molecular Diagnostics

Achievements:

Rapid growth in Molecular Genetic Testing

Figure 2 outlines the rapid growth in volumes within molecular genetics. In addition to volume, the test complexity is increasing with targeted and single analyte tests being with broad genomic analyses. Investment in research and development of technological advances and adaptation of Next Generation Sequencing approaches facilitated this rapid growth. This resulted in securing number of service contracts with MOH and CCO, through the province wide competitive EOIs. The Division of Molecular Genetics is now the provincial reference lab for tests including Mitochondrial Genome Sequencing, Charcot Marie Tooth Syndrome, as well as largest volume lab for Hereditary Cancer Testing. In somatic oncology, MolDx was the first laboratory to apply NGS based approaches to displace limited/targeted analyses for both solid tumour testing and hematologic oncology, greatly improving access to personalized care/therapy to cancer patients across Southwestern Ontario.

Figure 2: Volumes in Molecular Genetics

	NGS panels Constitutional	NGS panels Oncology	Sanger	PCR	Bank	Referred out	Total
2011	0	0	1522	1263	301	1293	4379
2014	0	0	2333	1827	388	1024	5572
2019	4144	2501	1267	3287	1502	2155	14856

Integration of Translational Research Program and Clinical Services in MolDx

As a clinical laboratory service situated in an academic hospital MolDx has embraced the mandate of research and innovation focused primarily on diagnostic biomarker discovery and diagnostic technology innovation. MolDx translational research laboratory, which is fully integrated within in the MolDx clinical labs has produced significant high-impact accomplishments in the last five years including:

- More than 40 peer reviewed publications including some in high impact journals such as Nature Communications, American Journal of Human Genetics, Genome Biology; one study recently being highlighted as one of the Top 10 studies impacting Clinical Genomics by the NIHGR.

- Development of technologies and biomarkers resulting in commercialization and clinical service contracts producing significant revenues (Millions of dollars per year from various sources including MOH, Pharma, Industry contracts).

- > $15M in research funding currently secured from federal funding agencies, foundations, and Pharma partners; including funding to lead the world-first, national clinical trial of in-house-developed technology for epigenomic testing of patients with hereditary neuro-developmental disorders.

- Launch of Canada-first "Clinical Genome Centre", MolDx and PaLM-led through LHSF and philanthropy support; with funding designated to provide broader access to genomic biomarker testing and personalized care to cancer patients and for molecular diagnostic technology development.

Select Test Development and Service Impact Highlights:

EpiSign

EpiSign is a methylation assay designed to readily identify proven and reproducible epigenetic signatures by assessing genome-wide methylation. EpiSign has multiple applications in the clinical setting. This test provides an additional diagnostic tool beyond the current sequencing and copy number technology paradigm. EpiSign Complete is a comprehensive analysis that includes 19 neurodevelopmental disorders. Using in-house developed machine learning over 50 newly discovered biomarkers have been published. We have partnered with organizations in the US and as well as Europe to provide diagnostic genome wide methylation analysis. In addition, the Molecular Genetics team was awarded translational research funds to launch EpiSign-Can, a study of 4000 patients to enhance diagnostic workup of complex genetic syndromes. MolDx is the central data repository and analytics center to a partnered program offering EpiSign as the world-first clinical whole genome DNA methylation test through partner labs in Europe and US.

Myeloid panel launch/rationalization of test utilization in cytogenetics

Diagnostic assessment of patients with suspected hematologic malignancies follows a complex triaged protocol involving flow cytometric analysis, anatomic pathology, cytogenetics and molecular diagnostics. Classically, molecular genetics assessment is reserved for patients for whom initial assessment by flow cytometry, cytogenetics or pathology indicates a possibility of a specific molecular subtype, followed by a targeted confirmatory molecular assay. This approach suffers from limitations including: inefficient coordination of complex triage procedures between different laboratories; insufficient specimens (often bone marrow) for repeat testing; increased turnaround times, and low diagnostic yield. It is only recently that scalable, high throughput, and high sensitivity-clinical-grade technology has become available enabling combined DNA sequencing and RNA-based assessment of fusion oncogenes. Now in routine clinical use, a NGS-based sequencing and gene fusion panel will be utilized for every patient specimen, in parallel to the standard karyotype assessment and flow cytometry. The panel includes assessment of 40 key DNA target genes, along with 29 driver genes involved in over 600 clinically relevant gene fusions. Clinical validations highlighted an analytical sensitivity of 5% for detection of DNA sequence mutations (including small in/dels and more complex mutation such as FLT3 ITD) and 1% for detection of gene fusions. This approach offers considerably simplified molecular testing protocol (single common assay for all specimens), reduced TATs, and substantially increased molecular diagnostic yield in this patient population. The collaborative efforts of many departments to break silos and bring this multidisciplinary approach to the diagnosis of myeloid disorders has reduced turn-around times, brought efficiencies to test utilization with a net cost savings. In addition, we have attracted the attention of other clinical centers such as Windsor Regional Cancer Center and Owen Sound who have chosen to redirect myeloid test requests to London, recognition of providing superior patient care.

Circulating Tumour DNA Testing

Circulating tumour DNA testing is a novel modality with Molecular Diagnostics being only one of the two Canadian labs currently performing in clinical setting. Non-small cell lung cancers (NSCLC) account for nearly 85% of all lung cancers, with 10 to 40% of those tumors having mutations detected in the epidermal growth factor receptor (EGFR) gene. Identifying the mutation enables the selection of more targeted therapy with improved patient prognosis. Currently, tissue biopsies are required for appropriate determination of the tumour's pathology, including genetic analysis for the presence of mutations. Biopsy is highly invasive and at times may prove to be challenging due to the tumour's location. Additionally, some patients with a previously identified EGFR mutation treated with novel therapies progress despite treatment and require second line therapy. To overcome these challenges, a clinically validated test, Cobas® EGFR Mutation Test v2, capable of detecting EGFR mutations in NSCLC DNA circulating in the peripheral blood is being offered by the LHSC Molecular Genetics Laboratory. This new test has successfully reduced the need for invasive biopsy procedures and provided significantly faster turn-around times to support the management of NSCLC.

Challenges:

1. Lab Space

With vigorous growth comes the need for more physical space. Through the application of technology, automation, and time management, significant efficiencies in the use of space have been gained. We continually search for creative opportunities to convert underutilized space

within and nearby the existing footprint of the Molecular Diagnostics division. There are ultimate limits to those space constraints, and therefore, a long-term plan needs continued development.

2. Recruitment

Recruiting high quality credentialed professionals and technical staff has continued to be a challenge in a highly competitive field where growth and demand has far outstripped the supply at all levels. We have endeavored to create a stimulating, rewarding and progressive workplace that is attractive to potential candidates looking to build a long term career in the Molecular Diagnostics division. By developing a critical mass of highly qualified personnel, a vigorous publication record in first tier journals, and demonstrating vision for growth and opportunity, we are starting to see increased interest that we hope to capitalize on.

3. Lab Test Licensing

For some time now the Ministry of Health has struggled to assimilate genetic testing within Ontario. This has created long delays in the granting of test licenses and funding arrangements. These delays have hampered development and provision of much need genetic testing within Ontario. Through participation in MOH working groups and strengthening relationships within the ministry we are starting to see the early consolidation and development of a funding framework in the area of molecular testing across constitutional genetics and somatic genetics. Continued participation in this area will ensure an equitable and fiscally responsible process in test licensing and funding in the coming years.

4. Professional Training Programs

A major challenge in recruitment of clinical professional staff in MolDx has been a limited number of graduates completing the diagnostic training programs. Clinical Molecular Genetics and Clinical Cytogenetic specialties require training in a Canadian College of Medical Genetics or American Board of Medical Genetics (CCMG or ABMG) certified training site.

MolDx is currently in the process of completing required documentation to commence with the application process for a training site licensing through the CCMG. Once approved, a major challenge will be to create the bandwidth for teaching/training for both didactic and non-didactic components of the training and will require new course development. A priority will be to a) identify professional staff leads with interest in developing this program, and b) ensure they have the required resources and support.

Division of Microbiology

The Division of Microbiology has undergone a tremendous transformation during the past 5 years and is now staffed by 2.5 Medical Microbiologist and 2 Clinical Microbiologists as well as a new Coordinator and a full complement of technical staff. Staff turnover has led to a rejuvenation and the ability to take on new projects; most noticeably regional microbiology services which include clinical support for infection control, antimicrobial stewardship and on-call services. Now, the LHSC microbiology group oversees not only all microbiology for the London hospitals but also the microbiology services for Strathroy, Woodstock, Ingersoll, Tilsonburg, St. Thomas and Chatham-Kent. This regional service allows for a common platform of quality microbiology testing as well as access to dedicated microbiology professionals for London and surrounding hospitals. Due to

increasing volumes the lab is preparing for the next transformation project to implement Total Lab Automation.

The collaborative partnership between virology and molecular diagnostics is continually being developed and in order to build redundancy in technical human resources and equipment. The incredible response of the microbiology lab to implement COVID-19 testing within a matter of days is a testament to the ability of this lab to manage change. Infection Control at LHSC is overseen by the microbiologists and the response to the recent pandemic while appropriate has revealed that further professional resources are needed.

With these successes have also come further challenges. The ability of professional staff to support both London and the region is stretched to capacity and any further regional expansion will require additional staff. This has been highlighted during the SARS-CoV-2 pandemic during which the microbiology professional staff were stretched to capacity while providing an exemplary response. Further support for infection control antimicrobial stewardship and regional implementation of standardized processes is also required. Dedicated facilities for molecular microbiology testing are needed in order to work effectively and maintain workflows in the divisions of Microbiology and Molecular Diagnostics. The hospital has committed to Total Lab Automation and the resources necessary to develop and implement this system will be significant.

C. The Adequacy of Hospital Resources to Support Workload

The hospital supports the Department through the global budget and for successive years annual decreases in the overall budget have been passed onto all departments in a similar percentage. Annual decreases in budget had led to cost cutting exercises and the search for more efficient means to provide our diagnostic services. These decreases have often been accommodated with staff reductions and as a result there is very little margin to deal with increasing volumes and any strains on the system. Shrinking hospital resources have been most acutely felt in these areas:

- Capital equipment – Every year the capital equipment replacement/request list has been carefully vetted to ensure that resource requests were based in replacement need or a business case. The list contains replacement requests for equipment that is well past its “best before” date and very little room is given over to new equipment or innovation. Routinely, the requested list adds up to approximately 3.5 to 4 Million dollars a year in order to achieve sustainable fleet of lab equipment. The Pathology Program has been the recipient of significant capital investments for MolDx and Micro. A tracking system for Pathology is being designed and will require significant effort to achieve transformation in this lab. Similarly, the planned transformation to Total Lab Automation has significant benefits but will require investment in both capital and time to implement.

- Currently over 85% of the PaLM budget is dedicated to people – salary and benefits. With budget reductions there has been reductions in overall staff that leaves us with very little “breathing room” especially when faced with illnesses or disability. This lack of flexibility leads to increases in TAT and lessens our ability to spend time in planning or change management activities that require staff input.

- The Division of Molecular Diagnostic is working closely with clinical colleagues to identify and prioritize test expansion, development and implementation to best serve our patients. A business case that includes staff and technical resources and expertise is in progress and

nearly complete. The Department requires ongoing the support and investment necessary to continue to develop a comprehensive Molecular Diagnostics service.

- The volume of coroner's autopsy cases continues to grow. There is a concern that autopsy services including coroner's cases at regional hospitals are being reduced or eliminated. The number of cases in southwestern Ontario are not insignificant and are beyond the current capacity of our current autopsy service in London.

10.2 Program of Laboratory Medicine

Overview

Pathology and Laboratory Medicine (PaLM) are a single department at both University and Victoria Hospitals. The Program of Laboratory Medicine consists of four (4) divisions, namely Biochemistry, Hematology, Transfusion Medicine and Transplant. In addition to supporting the core laboratories, Hematology provides specialty testing (including hemoglobinopathy coagulation testing and peripheral blood and marrow interpretation). Similarly, biochemistry supports specialty areas of Immunology, endocrinology, trace metals, biochemical genetics and toxicology. These specialty laboratories are located at Victoria hospital site with exception of transplant laboratory which is at University hospital closely linked to the Multi Organ Transplant Unit. The program has 6 clinical biochemists (Drs. Vipin Bhayana, Smith, Rutledge, Yang, Knauer, Stevic) and 1 hematology medical scientist (Dr. Ben Hedley) and 1 transfusion medicine specialist (Dr. Ziad Solh), and 4 hematologist (Drs. Chin-Yee, Hsia, Lazo-Langner, and Howson-Jan). Dr. Chin-Yee is a hematologist who is full time laboratory FTE who is also the Program Head of Laboratory Medicine. The 3 other hematologists do combination of laboratory medicine and clinical hematology.

The Program of Laboratory Medicine includes core laboratories which perform more than 90% of all routine testing with a human resource complement of more than 85 MLT FTE's. The Laboratory Medicine Program has undergone a dramatic transformation since the last department self-study in 2015. The goal was to modernize the high-volume core laboratories and to support regional partners. Hand-in-hand with the transformation is a new focus utilization (*Choosing Wisely*) and process improvement. In addition, specialty areas, such as flow cytometry, mass spectroscopy and immunology, are now refocused on regional support and on new test development.

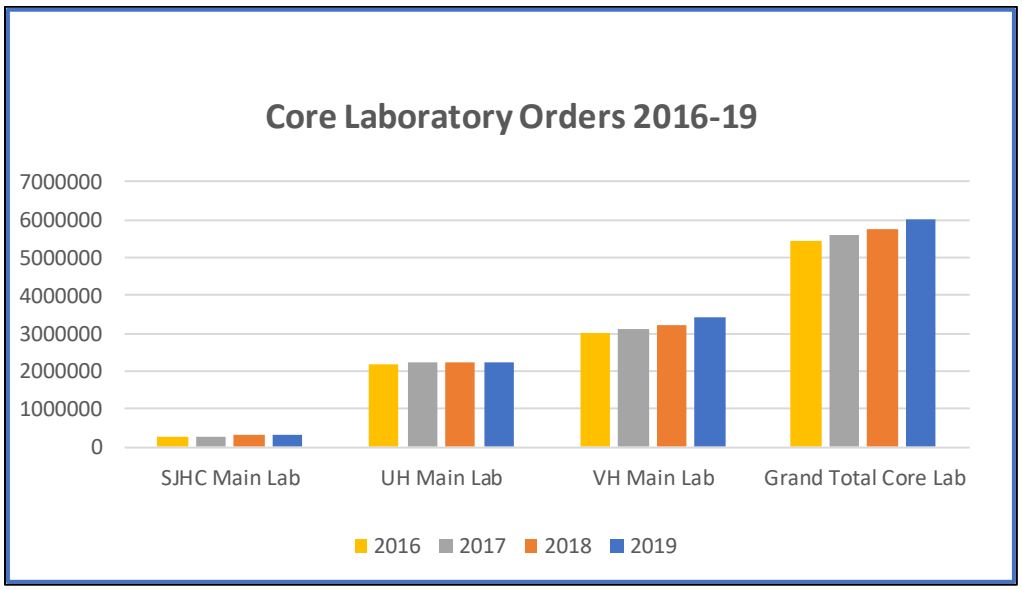
The bringing together of hematologists, biochemists and microbiologists within PaLM broadens the experience and expertise of the Department allowing for greater collaboration amongst the faculty and administrative streamlining of shared tasks. More importantly, it has facilitated collaborative initiatives to improve utilization across groups, for example molecular diagnostics and hematology, microbiology and core labs, and greater interaction with our clinical colleagues in the Departments of Medicine, Oncology and Surgery. As a result, laboratory medicine has been able to spearhead changes in utilization of testing and take leadership role in Choosing Wisely at hospital level. These changes have also resulted in an increase in academic productivity within the group in terms of publications, invited lectures and grant applications.

Core Transformation

Total Laboratory Automation in the core labs has helped improve efficiency and turnaround times. Mike Kadour (Laboratory Director) and Richard Bak (Manager, Laboratory Medicine) involved all stakeholders in this process including bench technical staff and medical staff resulting in both buy in and success in accomplishing this project. This is the first automated Roche line in Canada with ability to handle hematology, chemistry, immunoassay and urine testing with an automated sample storage. Our test menu almost doubled from 63 tests to 102 with capacity to add more tests if needed. Chemistry throughput increased from 4500 tests/h to 7600 tests/h. This improvement in processes resulted in transfer of number of endocrine tests previously performed in specialty laboratories to the core laboratory environment with improved turnaround time and cost savings. Consolidations of tests on one line also led to fewer blood tubes drawn per patient, which also meant less risk of iatrogenic anemia and perhaps reduced rate of transfusions. Core laboratory

volumes (**Figure 1**) have increased year over year but have in part been mitigated by laboratory utilization projects and *Choosing Wisely* efforts.

Figure 1: Core Laboratory Volumes



Previously identified in the 2015 self-study was the threat that several medicine professional staff (MDs and PhDs) were at or near retirement age. We have managed to hire two young biochemists (Dr. Michael Knauer in 2017 and Dr. Ivan Stevic in 2019), one transfusion medicine specialist (Dr. Ziad Solh, 2017) and created the new position of Medical Scientist in Hematology (Dr. Benjamin Hedley, 2019) despite budgetary shortfalls, largely based on regional demands for PaLM support. The clinical biochemists in charge of the core laboratory and the POC and the Medical Scientist in Hematology position (Dr. Ben Hedley) address day-to-day issues and focus on improving processes, utilization and academic productivity.

The Hematology Laboratories are supervised primarily by hematologists in the Department of Medicine with cross-appointments in PaLM, but only the Program Head, Dr. Chin-Yee, is a full-time PaLM FTE since 2016. This has allowed Dr. Chin-Yee to have greater focus on laboratory program issues and provide leadership in core transformation and spearhead utilization efforts, including *Choosing Wisely* across the hospital. Their clinical link has helped facilitate laboratory interactions and relationships, particularly in initiatives such as *Choosing Wisely*. The potential weakness of not being primarily laboratory-dedicated physicians is compensated by strong regular interactions with senior technical staff and Dr. Ben Hedley. There are now two dedicated laboratory physicians who oversee the Hematology and Transfusion Medicine Laboratories, but additional medical laboratory staff would further strengthen and provide leadership for the laboratory component of PaLM. Current efforts are being made for future laboratory-dedicated staff by relocating some of the hematologists to the laboratory area.

The Biochemistry Laboratories are supervised by clinical biochemists who also have appointment in PaLM with cross-appointment in the Department of Biochemistry at Western. Biochemists are involved in teaching undergraduate students, residents, fellows and laboratory technologists. Their sophisticated skills in toxicology (Dr. Norman Smith), trace metals and immunology (Dr. Liju Yang) and endocrinology (Dr. Angela Rutledge) have made the LHSC laboratory one of the exceptional,

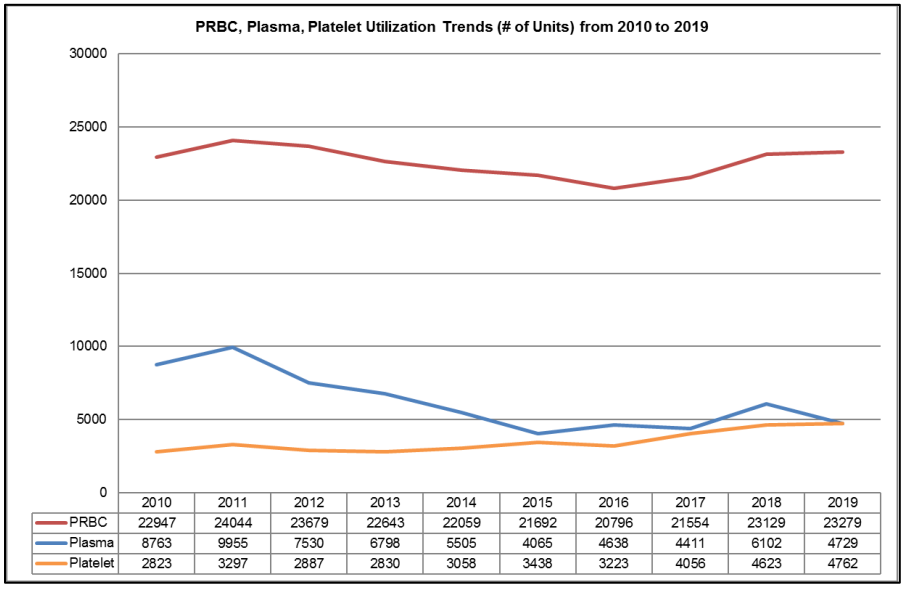
highly-specialized labs in Canada. Our biochemists (Drs. Vipin Bhayana, Michael Knauer, Angela Rutledge and Ivan Stevic) provide supervision and guidance to achieve highest quality standards not only at the local core labs but also to the regional laboratories in Southwestern Ontario.

Transfusion Medicine

Transfusion Medicine continues to be one of the highest volume transfusion laboratories in Ontario and Canada. The Transfusion Medicine Laboratories (located at Victoria and University Hospital) are supported by 25 FTE's Medical Laboratory Technologists (MLT), 3 full time Senior MLT, and a Transfusion Safety Officer. The integrated, dedicated staff and leaders are a productive team and for the first time in 2017, a dedicated Transfusion Medicine specialist, Dr. Ziad Solh, was hired to bolster clinical academic enterprise. Dr. Solh's interest in transfusion and knowledge translation has led to number of efforts to improve safety and utilization at LHSC and our regional partners.

Highlights since 2016 include evidence-based transfusion practice for Adult Transfusion Guidelines, Neonatal and Pediatric Transfusion Guidelines. The screening of packed red blood cell orders for non-bleeding adult patients (quality improvement initiative) as per guidelines also continues. These measures promote one unit and reassess (vs. two units) red blood cell transfusion. An additional goal for 2020 is to begin plasma order screening by MLT. Utilization of evidenced based indications and dosing regimens for intravenous immune globulin (IVIG) treatment is mandated by the Ontario Ministry of Health and Long Term Care. In 2019, London Hospitals IVIG utilization has increased slightly (less than the Canadian Blood Services projected increase). The London Hospitals rate of pre-transfusion blood sample errors, Wrong Blood in Tube (WBIT), has further decreased and is in keeping with reported acceptable rates. This success is attributed to implementation of Cerner Specimen Collect system employing bedside bar code scanning technology to minimize specimen mislabelling.

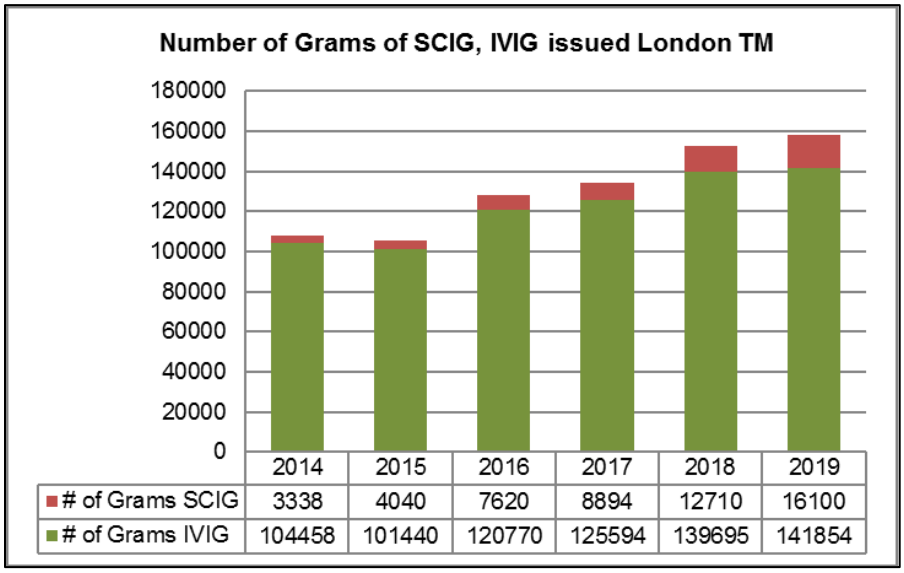
Figure 2: Blood Product Utilization (2010-2019)



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
PRBC	22947	24044	23679	22643	22059	21692	20796	21554	23129	23279
Plasma	8763	9955	7530	6798	5505	4065	4638	4411	6102	4729
Platelet	2823	3297	2887	2830	3058	3438	3223	4056	4623	4762

BC Utilization Trend; Continues above 10-yr average (3.1% above in 2019; 2.3% above in 2018)
Plasma Utilization Trend; Continues below 10-yr average (24.3% below in 2019; 11.1% above in 2018)
Platelet Utilization Trend; Continues above 10-yr average (36.1% above in 2019; 40.8% above in 2018)

Figure 3: Immunoglobulin Utilization (2014-2019)



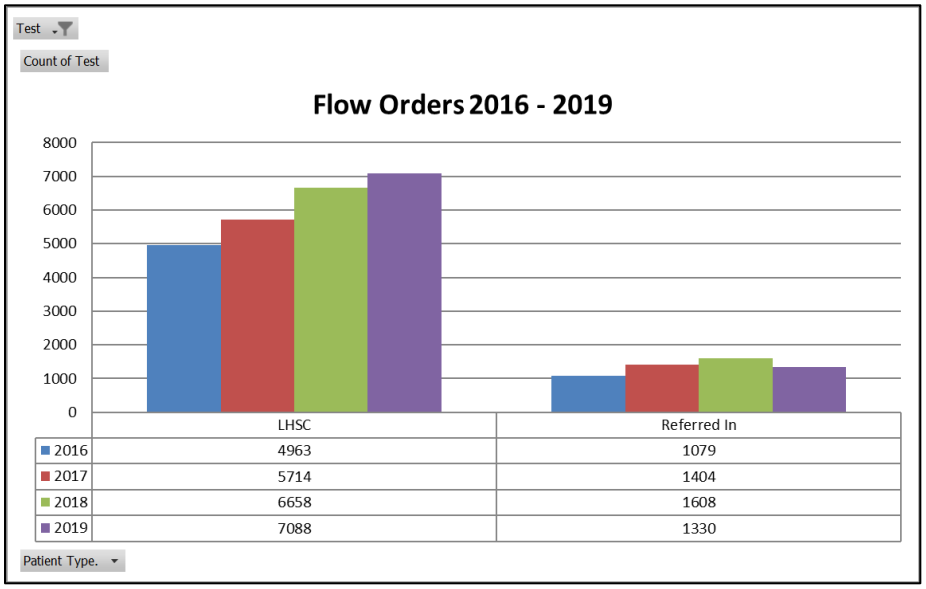
Per Canadian Blood Services data, total grams fiscal 2019/20 Canada year on year per cent growth is forecast to be 7.3 %. London: 3.6 % increase **total grams** from 2018;2.6 % decrease **total number patients** from 2018. Subcutaneous Immune Globulin (SCIG) Home Infusion Program (initiated in 2016) continues to grow with 80 patients enrolled as of December 31, 2019

Specialty Areas and Regional Support

Many services in Laboratory Medicine are unique not only to our region, but also provincially and nationally. Regionalization, redistribution and rationalizing of specialty laboratories have lead shifts in workload (**Figure 4**).

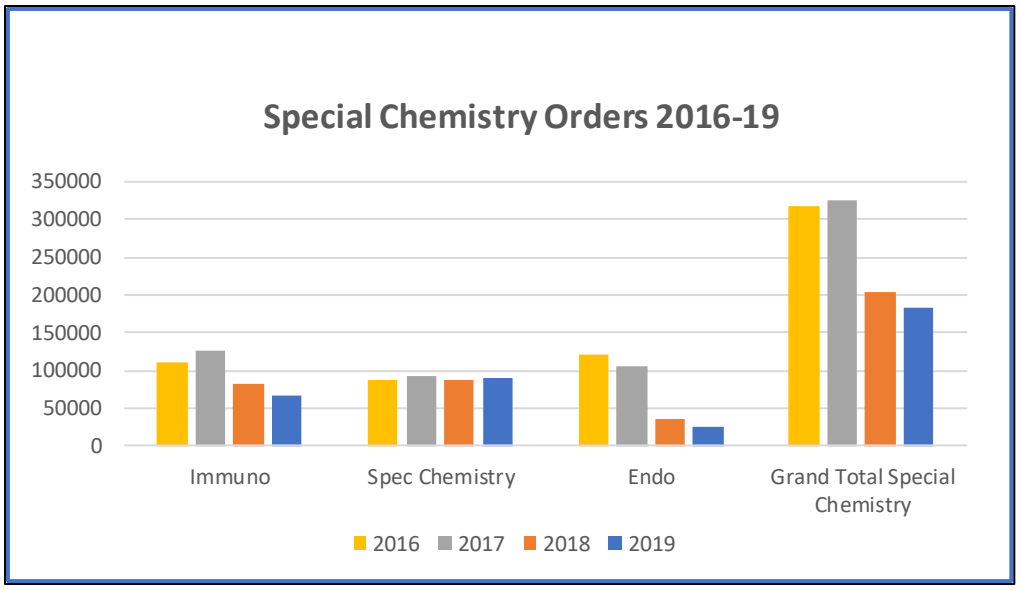
Flow cytometry workload continues to increase with shifts in work to PaLM from the region. The Flow Cytometry Group, a collaboration between hematopathology and hematology, has long been considered a leader at the International level in the area of method development. We are one of only two laboratories in Canada that are certified to test for Minimal Residual Disease (MRD) in Acute Lymphoblastic Leukemia and have consistently published over the last decade in leading journals.

Figure 4: Flow Orders (2016-2019)



There has been a significant decline in special chemistry test volumes (**Figure 5**) because of tests being discontinued or moved to outside labs (e.g. Maternal Serum Screening, Allergy testing) or transferred to core lab as part of transformation process (endocrine tests). The Trace Elements and Toxicology laboratories are unique services and continue to generate significant income for the laboratories. New state-of-the-art automation instruments manufactured by EUROIMMUN were implemented as part of the transformation project to test for antinuclear antibodies (ANA) and several other autoantibodies by the immunofluorescence assay (IFA) and immunoblot method. Immunology has collaborated with clinical partners in the Division of Rheumatology (Medicine) and the Division of Neurology (CNS) and has developed new antibody panels for screening autoimmune neuropathies and myopathies, a service it hopes to expand across Canada. LHSC is one of the leading centres in Canada for testing expanded autoimmune encephalitis and paraneoplastic antibodies panels. Investment in this automated system has significantly reduced hands-on time for performing the tests and has also increased test efficiency. It has allowed us to expand our scope of services and perform several new technically challenging tests.

Figure 5: Special Chemistry Orders 2016-2019



Utilization and Process Improvement

Two of the primary goals of Laboratory Medicine is to improve and streamline processes with the Core Laboratory transformation and automation, and to improve laboratory utilization for both routine laboratory and specialty testing. In the previous self-study report in 2015, utilization was felt to be suboptimal in terms of volumes and appropriateness. Under the leadership Dr. Ian Chin-Yee, Program Head, Laboratory Medicine since 2016, PaLM has undertaken more than 24 different projects aimed at improving utilization across all laboratories, including transfusion medicine, molecular diagnostics, biochemisty, hematology and core laboratoies. Utilization projects are on-going and all new order sets are reviewed and modified by laboratory medical leaders with the goal of reducing redundant or unnecessary testing, decoupling linked tests, reducing laboratory reflex testing and using as much automation as we have already available. Many of the projects are part of the *Choosing Wisely Canada* (CWC) campaign to reduce overuse in hospitals while others are local initivatives aimed at improving utilization and reducing redundant or repetitive testing.

Highlights inlcuded reducing daily "routine" blood testing on general medicine wards, eliminating or reducing testing for folate, Vitamin D, ESR, Fecal occult Blood Testing, Ova and parasites (see table). In Transfusion Medicine, we have sucessfully reached our target of greater than 80% single unit RBC transfusions and have one of the best records for fewest product outdates in the province. Many of the intiatives are novel, such as rationalizing cytogenetic testing in the era of Next Generation Sequencing, and demostrate our leadership in both quality and process improvement in laboratories to more effectively manage our resources. These efforts have lead to a number of publications in peer-reviewed journals and renewed enthusiasm among frontline staff aiming to make an impact on healthcare delivery.

The leadership of PaLM in improving utilization has catalzyed other areas within LHSC and the region to undertake similar CWC campaigns under our mentorship. The process has engaged mutiple stakeholders across many departments, including nursing, pharmacy and medical staff who are now actively enaging in their own quality improvement initaitives often with the support and mentorship of the laboratory. LHSC was recently recognized for being one of only three

hospitals in Onatrio to attain the *"Choosing Wisely Canada Hospital"*designation (Level 3) for the number of projects undetrtaken and our leadership role both provinically and nationally. Over time, it is estimated these efforts will lead to cost avoidance of close to $1 Millon annually.

Utilization Initiatives	Tests Affected
daily bloodwork in medicine	CBC, Lytes, Creatinine, Urea, INR/PTT
CRP/ESR	Previously coupled order - now limited indications for ESR
RBC Folate	Removal RBC folate from test menu
Urine Eosinophils	Removal of testing
FOBT for ED and inpatients	Removal of testing
INR/PTT decoupling	Decoupling in powerplans
Creatinine/Urea decoupling	Decoupling powerplans
AST/ALT decoupling	Decoupling powerplans
Amylase reduction	Removal of amylase
CK/ Trponin decoupling	Decoupling powerplans in ED
25- Vit D	Limited indications using CDS
25-OH- Vit D	Limited indications using CDS
Repeat Hb A1c	Limited repeat orders using CDS
Repeat TSH testing	Limited repeat orders using CDS
IFE	Serum and urine IFE
reflex T3/T4	Reflex T3, T4
D Dimers	Computer Decision Support algorithm
Cytogenetic testing	Triage cytogenetics (started September 2019)
Cytogenetic testing	CLL FISH panel (now a single probe set as opposed to 4)
Flow cytometry	Tonsillar lymph nodes on children
Ova & Parasite testing	Utilization paper tool introduced
Resp virus testing	reduction due to summer algorithm restriction
Body fluids	reducing manual differential for peritoneal dialysis fluids
C. diff testing	Restriction and two step testing

Academic Activities

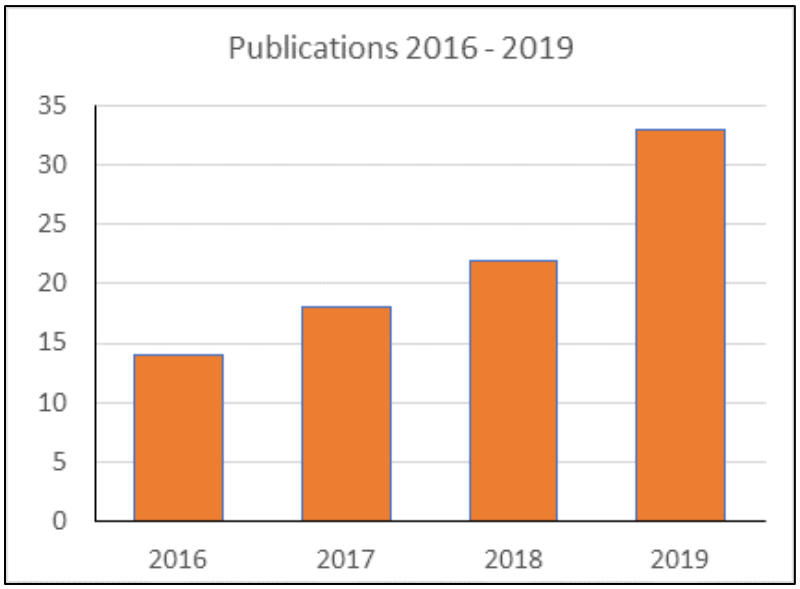
Academic activities in Laboratory Medicine have always included a strong commitment to teaching both undergraduate and graduate students at Western University, as well as postgraduate trainees in Hematology, Pathology and Anesthesia. Also included are Medical Technologist trainees from Fanshawe (London) and St. Clair (Windsor) Colleges.

Undergraduate teaching includes clinical biochemistry courses (3386b and 4890E), Foundations of Medicine course and a block in Hematology. In addition, a number of undergraduate research projects have been supervised laboratory medicine faculty in the Department of Pathology and Laboratory Medicine. Postgraduate trainees in Hematology spend six months in the laboratory and other specialties, including allergy and immunology; anesthesia and pathology, rotate through Laboratory Medicine with discipline-specific interests.

One focus, which was previously identified as a "weakness" (because of busy clinical service demands) was the number of peer-reviewed publications. Since 2016, we have specifically focused on three areas which synergize with our clinical themes – utilization, new test development and

process improvement. This focus had led to an increase in publications and recognition of our group as leaders in Laboratory Medicine (Figure 6).

Figure 6: Publications by Faculty in Laboratory Medicine Since 2016



Areas for Improvement

- Human Resources - Laboratory Medicine professional staff (6 FTE biochemists, 3.5 FTE in Hematology/Transfusion) are limited in number for clinical service for our volume, size and expanding demands for support from the region. Hiring is limited by hospital finding positions and Ministry of Health support. In addition, several current professional staff (3 biochemists, 2 hematologists) are nearing retirement age and will need to be replaced and the availability of trained professional staff in Laboratory Medicine is limited.
- Senior technology staff with years of clinical experience who have been the backbone of Laboratory Medicine are now retiring with few new technologists at this level of expertise available to replace them. Training the next generation of senior technologists with discipline-specific expertise is challenging due to limited number of medical technologists graduating.
- Availability of physical office space limits hiring of new professional staff who ideally should be situated next to the laboratories.
- The growth in diagnostics with many new tests coming into the market; however, we do not have the structure nor the funds to support. Even proven useful tests incorporated into clinical guidelines (e.g. BNP and Procalcitonin) are still not available at LHSC.
- Development of new and novel testing is limited by a budgetary freeze on new test introduction. Point-of-care testing is a rapidly growing area in Laboratory Medicine and one of the most challenging areas to maintain quality control and accreditation. With increasing demands, there is insufficient resources to manage the ever-increasing accreditation requirements.
- Referred-out testing for low-volume tests or highly specialized tests to other centres are escalating in cost. Many of these tests are sent to US laboratories at great expense. The ability and costs of repatriating these tests is also limited by current budgetary freeze on new test development. A provincial or national strategy is required for esoteric testing.

- Ongoing research productivity in the areas of test development and utilization and process improvement needs additional support to be sustained. Specifically, for utilization efforts need support from business intelligence and laboratory information system to facilitate identification of areas for improvement and impact of interventions.
- Regionalization provides both an opportunity and a threat. The opportunity rests with PaLM to harmonize regional testing onto similar platforms and provide specialty testing and expertise to the region. Regional laboratories are struggling with many of the same issues listed above with aging staff, but without additional support current medical professional staff and senior technologist risk being over extended by regional demands. PaLM has identified this as a problem and is moving toward additional hiring.

Summary

The Laboratory Medicine program has taken significant and impactful steps forward since 2015. There is a stronger collaborative relationship, administrative structure, academic commitment and strategic plan in PaLM.

This transformation has been driven by both Core Laboratory transformation/automation as well as implicit change in strategic direction by the leadership group. Renewal in Laboratory Medicine has strengthened PaLM as a whole. The strategic direction shared by the Chair/Chief of PaLM and the Program Leader of Laboratory Medicine focuses on utilization and process improvement and development of specialty testing. This direction needs ongoing support and nurturing to meet the challenges of clinical demands and to continue to grow as a regional, national and internationally recognized academic laboratory group.

11. Healthcare Leadership

Our faculty members are involved in leadership roles and several international activities and in the health care and academic arenas. Their efforts have been duly recognized through several awards locally, nationally and internationally.

Here are some examples:

11.1 Leadership

Dr. Meg McLachlin has served on the Laboratory Medicine section of the OMA in various leadership roles and is currently on the Tariff Committee. Dr. McLachlin previously chaired the Pan-Canadian Cervical Screening Network. She was a member of the Quality Initiative in Interpretive Pathology (QIIP), a pan-Canadian collaboration of pathology.

Dr. David Driman has served as Chair of the Royal College Anatomical Pathology Examination Board. He has worked extensively with the Canadian Partnership Against Cancer (CPAC) and Cancer Care Ontario (CCO) on guideline development in several areas of gastrointestinal pathology and chaired the CPAC Working Group on guidelines for colorectal polyp reporting. Dr. Driman is the current CCO Regional Pathology Lead for LHIN 2, Chair of the CPAC Colorectal Cancer Expert Panel and the Canadian representative on the College of American Pathologist's Gastrointestinal Cancer Protocol Review Panel.

Dr. Helen Ettler and Dr. Nikhil Sangle have both served as Pathology Quality Management Program Regional Leads.

Several members of our department (Drs. Edward Tweedie, Manal Gabril, and Bret Wehrli) have served as examiners for the Royal College.

Dr. Bertha Garcia served as Vice Dean, Education, Schulich School of Medicine & Dentistry, Western University (2008-2017) and is currently Vice Dean & Director of Dentistry, Western University.

Dr. Candace Gibson served as Assistant Dean, Basic Medical Sciences Undergraduate Education until June 30, 2019 and is now Vice Dean, Basic Sciences, Schulich School of Medicine & Dentistry, Western University until June 30, 2020.

Dr. Michelle Weir has served as Chair of Canadian Society of Cytopathology. She is also Co-Lead of the Accreditation Committee and Medical Education Quality Committee for the Schulich School of Medicine & Dentistry, Western University.

Dr. Subrata Chakrabarti served as Chair of CCPLM and is a steering committee member of OMPRN

Dr. Jeremy Parfitt is the Director of the Management Committee of London's Branch of the Ontario Tumor Bank.

Dr. Jeremy Parfitt and Dr. Mariamma Joseph have served as council members of the Laboratory section of OMA.

11.2 International Activities

Dr. Subrata Chakrabarti has authored multiple publications, supervised students and visiting scientists in collaboration with five institutions in China and one in India. He is the Schulich School of Medicine & Dentisty's Lead for its Asia initiative. He is also a visiting faculty member at several Universities in China and in India. He is the recipient of two China Canada CIHR grants.

Dr. Zia Khan is a visiting faculty member at Wenzhou University. He has recently developed a Graduate Diploma in Pathology (Section 6.1) with a focus on visiting graduate students.

Dr. Wei-Ping Min, Dr. Tao Rui and Dr. Tianqing Peng are visiting faculty members at, and have extensive collaborations with, universities in China. They have authored multiple publications, supervised students and visiting scientists and received international funding.

Dr. Francisco Olea Popelka (One Health Network) has ongoing collaboration with Scientists in:

United States of America
- Beaumont Health System
- Disney Animal Kingdom Nutrition Center

Europe
- Department of Agriculture and Food, Ireland
- Marine World Health Organization, Switzerland
- International Union Against Tuberculosis and Lung Disease, France

Africa
- Makerere University, Uganda
- Victoria Falls Wildlife Trust, Zimbabwe
- University of Global Health Equity, Rwanda
- Talaku Community Based Organization, Kenya
- Kruger National Parks Veterinary Services, South Africa

Dr. Art Poon is collaborating with the Chinese Center for Disease Control and Prevention to analyze HIV-1 data to set up a clinical pipeline for Next-Generation Sequencing (NGS) analysis. He was an invited member of a working group convened by the US NIH to develop guidelines for public health applications of HIV phylogenetics.

Dr. Michael Shkrum has collaborations and authored publication with scientists in Kenya .

Dr. Ziad Solh's Transfusion Medicine Lab and Red Cell Disorders Clinic sees patients with complex conditions, which are prevalent mostly in the immigrant population in Canada.

Several projects by Dr. Lloy Wylie aimed at addressing health equity through the Local Solutions for Global Problems IDI and supporting refugee social integration across multiple countries.

11.3 Awards

Our departmental faculty and staff members have received multiple awards for teaching, research and service since 2015. External, Western and Schulich School of Medicine & Dentistry awards are listed below.

Faculty (since 2015):

Dr. Vipin Bhayana
Lifetime Achievement Award, Ontario Society of Clinical Chemists (OSCC)

Dr. Subrata Chakrabarti
William Boyd Award, Canadian Association of Pathologists

Dr. Ann Chambers (Professor Emerita)
Fellow of the Royal Society of Canada (FRSC)

Dr. Nancy Chan
Schulich Excellence in Education Award for Graduate/Postgraduate (Educator), SSMD

Dr. Mark Darling
Western Students' Council Teaching Honour Roll: Award of Excellence (Dentistry)
Schulich Continuing Dental Education Award, SSMD
W.W. Wood Award for Excellence in Dental Education, ACFD

Dr. David Driman
Leadership in Education Award, Canadian Association of Pathologists

Dr. Bertha Garcia
2015 ASPIRE Recognition of Excellence in Student Engagement in a Medical School
Douglas Bocking Award for Outstanding Contributions to Medical Education
Lifetime Achievement Award, Schulich School of Medicine & Dentistry
Leadership in Education Award, Canadian Association of Pathologists
YMCA Women of Excellence Award (Health, Science and Technology Category)

Dr. Candace Gibson
Canadian Health Information Management Association, Tribute of Excellence Award

Dr. Aaron Haig
Western Students' Council Teaching Honour Roll: Award of Excellence (Medicine)

Dr. Rob Hammond
Class of '42 Award, SSMD

Dr. Rebekah Jacques
Martin McKneally Capstone Project Award, University of Toronto Joint Centre for Bioethics

Dr. Meg McLachlin
Leadership in Patient Safety & Quality Assurance Award, Canadian Association of Pathologists
Kulcsar Lectureship Award, Canadian Cytopathology Society

Dr. Art Poon
Dean's Award of Excellence (Junior Faculty), SSMD

Dr. Bekim Sadikovic
Dean's Award of Excellence (Research), SSMD

Dr. Nikhil Sangle
Dr. L. Clarke Jr. and Elaine F. Stout Award (USCAP)

Dr. Teresa Van Deven
Schulich Excellence in Education for Undergraduate Education (Educator), SSMD

Dr. Joanna Walsh
Western Students' Council Teaching Honour Roll: Award of Excellence (Medicine)

Dr. Bret Wehrli
Schulich Excellence in Education Award for Graduate/Postgraduate (Educator), SSMD

Dr. Michele Weir
Schulich Excellence in Education for Undergraduate Education (Leader), SSMD

Staff (since 2015):

Ms. Susan McRae
Hugh Curry Award, Canadian Association of Pathologists