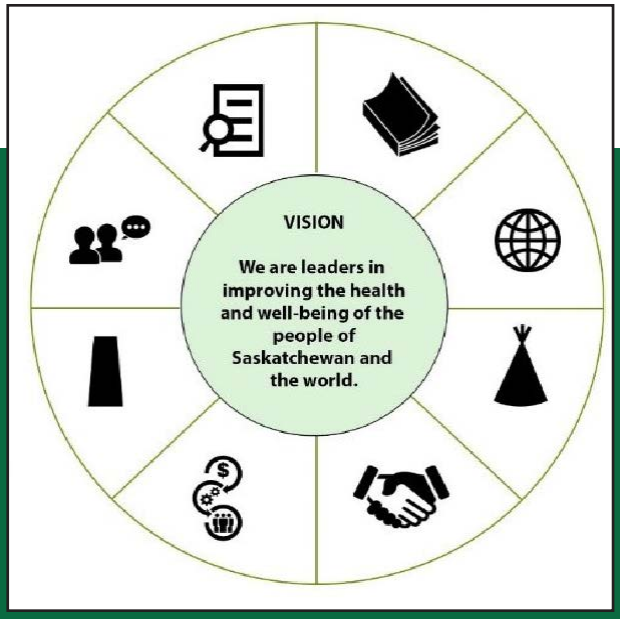

PROVINCIAL DEPARTMENT OF LABORATORY MEDICINE

Self-Study
MAY 2020

UNIVERSITY OF SASKATCHEWAN
College of Medicine
DEPARTMENT OF PATHOLOGY AND LABORATORY MEDICINE
MEDICINE.USASK.CA

Saskatchewan Health Authority

TABLE OF CONTENTS

As we work together each day in our Province, we acknowledge we are on Treaty 4, 5, 6, 8 and 10 Territories and the Homeland of the Métis. We pay our respect to the First Nations and Métis ancestors of this place and reaffirm our relationship with one another.

ACKNOWLEDGEMENTS

I would like to express sincere appreciation to those Department members who found time in their busy schedules to provide input to this document. I would also like to honor the hard work and dedication of all Department members who make a significant contribution to patient care on a daily basis.

On behalf of the Department I would like to take this opportunity to express our sincere gratitude to various Foundations whose generosity has enabled us to avail of many significant opportunities for improvement, including access to fellowship training programs, implementation of specimen transport tubing systems and tissue tracking systems and the introduction of genomic technologies to a number of our laboratories. Without their support, none of these initiatives would have been feasible.

Finally, I would like to thank my Finance and Administrative Manager for overseeing the administrative aspects of ensuring the document's collating and formatting.

Dr. Fergall Magee
Provincial Head
Department of Pathology & Laboratory Medicine

Section 1 - Update since last Departmental Review

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a) When was the last review?

The last external review of the Department of Pathology and Laboratory Medicine (as it was then termed) occurred 26/27 AUG 2010 **(Appendix 1).** This review was confined to departmental activities in Saskatoon.

b) Was the review combined with a departmental leadership review?

No; however, the review recommended strategies to recruit a highly qualified Chair/Chief of Department.

c) Briefly outline any specific recommendations from the last review.

The 2010 External Review recommended the formation of a strategic planning committee, appointment of a Division Head for Anatomic Pathology (the reviewers had commented that '*the issues and challenges facing the Division of Anatomical Pathology are key to the future of the entire department'*), a retreat for the search committee to *'ensure that they understand the (then) current critical situation of the department'*, annual performance reviews about to be implemented, development of a quality management plan, consolidation of all anatomic pathologists to one site, integration of all faculty into a 'single faculty' model and development of 'provincial co-ordination for the provision of laboratory service', (please see Accountability and Performance document in **Appendix 1**).

d) Were the recommendations implemented?

Following the 2010 External Review, a Division Head was recruited to Anatomic Pathology (2013) resulting in the development of a Provincial Plan for Anatomic Pathology, implementation of annual reviews for all Anatomic Pathologists (now extended to the entire Department, the beginning of the process of consolidation of all Anatomic Pathologists to one site, Saskatoon City Hospital), re-invigoration of the Division of Anatomic Pathology Quality Assurance Committee, implementation of Patient Safety Rounds, and eventually the implementation of a Laboratory-Wide Quality Management System (QMS).(please see **Appendix 1)**

An Acting Department Head had been in place at the time of the review (Dr. Joseph Blondeau) but subsequently a national search was undertaken by an independent recruiting company ending with the appointment of a new Unified Department Head in DEC 2015 (JFM).

e) Briefly outline any changes still underway as a result of the last review.

The consolidation of Anatomic Pathology is still underway - most anatomic pathologists have been moved from St. Paul's Hospital to Saskatoon City Hospital, movement of some faculty from Royal University Hospital is under way. The College of Medicine is in the process of implementing a single faculty model, while a single integrated Health Authority was enacted in 2018, with the creation of a single integrated provincial program of Laboratory Medicine shortly afterwards.

f) Briefly outline any new or emerging factors/trends/issues that will likely have a direct impact on the department in the next 5 years.

1. General context

The rate of accrual of scientific knowledge is accelerating so rapidly that *it has become a struggle for all health care*

workers to keep abreast of advances in science in a culture not so much of Knowledge Transfer (KT) as of iKT (Impaired Knowledge Transfer)-please see **Appendix 1**).

2. Specific context

Financial Support

70% of all medical decisions are based on some form of laboratory medicine test, yet for many years and in many jurisdictions the value of laboratory medicine has been under-appreciated and laboratories underfunded. While financial restraint affects all components of health care in Saskatchewan, laboratory medicine is particularly vulnerable as a result of a long history of under resourcing. This is now exacerbated by increased demand due to population increase, demographic changes with proportionately more high users of laboratory testing (more older adults and children) and technological advances including genomic diagnostics, informatics, digital imaging and expanded point-of-care-testing (POCT) (please see next section-Technology). The absence, however, of secure and sustained funding to enable evidence-based staged growth of laboratory diagnostics - required to fulfill our growing clinical, public health and academic mandates - has led to our current state-*of relentless crisis with repeated reactive interventions*.

Human Resource Issues

Medical laboratory technologists (MLTS) and Combined X-ray / laboratory technologists (CXLTs) play a critical role in health care. A shortage of individuals with these skill sets will have a negative impact on health care - leading to delayed diagnoses, procedures and surgeries. Each year Canada produces 100 trainees less that it requires while 25% of the current workforce is within 10 years of retirement (Saskatchewan figures show similar trends - please see Expansion of the Medical Laboratory Technology Program at Saskatchewan Polytechnic, March 2016 **Appendix 1**). Despite the recently implemented expansion of the Medical Laboratory Program at Saskatchewan Polytechnic, this province struggles to fill vacant MLT and CXLT positions. In addition, given the rapid changes in diagnostic technology and increasing requirement for skills in informatics, significant curricular change will be required to provide these individuals with skill sets appropriate for current and future practice. Members of the department have brought presentations to LABCON (Banff)-2017), and MLT training centres in Halifax (Nova Scotia Community College-2016) Montreal (Dawson College-2017) and Toronto (Michener Institute-2020 – deferred because of pandemic) in an attempt to promote recruitment of these individuals to Saskatchewan.

Less than 4% of medical school graduates will enter a career in Laboratory Medicine **(Appendix 1**) while Canada's capacity to train PhD Laboratory clinicians is extremely limited. The department currently hosts a General Pathology (GP) Residency program (please see also Section 4). Of the almost twenty residents who have graduated from the program in the past 10 years-only one works as a General Pathologist-one additional individual works as a Hematopathologist-while all of the remainder work as Anatomic Pathologists. Converting at least one residency position to Anatomical (Surgical) Pathology (AP) might provide better alignment with future pathology requirements for the province. It would also allow recruitment of the 1-2 COM graduates who each year leave the province to seek training in AP elsewhere. Sadly, many of these trainees do not return to Saskatchewan.

The Department has for an a number of years striven to increase its profile among high school and undergraduate students by becoming a regular contributor to **Open House**, **Career Day** and by developing modules that highlight the importance of laboratory medicine related to specific COM courses-based on the premise-*no content without context*-and by an attempt to re-invigorate options for **student rotations** in Laboratory Medicine. The Department has also adopted a long-term plan to develop necessary skill sets for residents from within our own program. We have received significant support from the Hospital Foundations in Saskatoon who have contributed Fellowship Funding to enable these individuals to obtain skill sets in areas of great need such as gynecologic pathology, dermatopathology, and pediatric pathology. The intent is to continue this practice by sending future residents to fellowship training in the areas of breast pathology, genomics, informatics and medical education. Our ability to continue this highly successful initiative could be impaired by stipulations for rural employment imposed on some of our resident contracts by SaskDocs / Ministry of Health *in the absence of consultation with the integrated provincial laboratory medicine leadership team.* Initiatives have also been directed outside our Department (similar to our MLT drive) and the Department has hosted a **Saskatchewan Night** at our National Specialty Conference (Canadian Association of Pathologists-CAP-ACP) in an attempt to recruit residents from other programs-Quebec-2018 and Niagara 2019-this had been scheduled for 2020 (Halifax) but the conference has now been cancelled due to pandemic. A similar event was brought to the Resident Review Course in JAN 2020 (Toronto) and is planned for future review courses. In one further attempt to promote the province of Saskatchewan, Department members of CAP have worked hard to ensure that Saskatoon will host the **2021 CAP-ACP National Conference** (for the first time in almost 30 years).

Up to 25% of clinicians in Laboratory Medicine are not MDs. Clinical diagnostics and leadership in the areas of Biochemistry, Microbiology, Cytogenetics, Molecular genomics, Informatics and Tissue typing are frequently and increasingly provided by PhDs. Canada has a limited capacity to train PhD laboratory clinicians and relies on graduates from U.S. programs (2 of the past 4 PhD hires in Saskatoon come from U.S. programs). The difficulty of recruiting PhD clinicians is compounded by an inflexible culture surrounding their status within SHA, as is our current remuneration scale for PhDs.

As with the MLTs and CXLTs, an additional concern is the inability to match current curricular content of MDs and PhDs to the very specific needs of this province - informatics, genomics, test utilization and laboratory leadership. While a very specific recruitment plan is in place it is not enhanced by 'non-nimble decision making' at SHA and MOH level.

Documentation relating to current staff vacancies through provincial laboratory system in provided in **Appendix 1**.

<u>Technology</u>

Laboratory Medicine is currently experiencing major and rapid technology changes - genomic diagnostics, informatics, digital imaging and significantly expanded and sophisticated point-of care testing (POCT). Currently, plans are being developed to a POCT strategy similar to that recently introduced in Nova Scotia but significant investment will be required to achieve this proposed change. The Genomic explosion will revolutionize diagnostics in multiple areas

of diagnostic practice including pre-natal screening, new-born screening, metabolic diagnostics, cancer signature, and companion diagnostics, specific disease panels, tissue transplantation, pharmacogenomics, population health genomics and infectious disease. A strategy is being developed for a planned and staged expanded genomic capacity in the areas of Tissue Transplantation (**Next Generation Sequencing**-RFP in progress-and **NanoString** technology-funding secured from SPH Foundation), pre-natal screening for aneuploidy, expanded screening for childhood diseases and companion diagnostics for oncology therapies (Next Generation Sequencing); multiple documents have been prepared and multiple presentations delivered on all components of this planned expansion to many stakeholders including SHA, SCA, MOH, COM/ U of S and selected Foundations (please see **Appendix 1**). Success for these initiatives will require significant partnerships and support from the Ministry of Health and Provincial Foundations. The situation is similar for a planned incremental and sequential Implementation of Digital Telepathology (Surgical Pathology) or Cellavision (Hematopathology – funding now secured from SPH Foundation) initiatives that would support and enhance diagnostics in smaller rural centres as occurs in Quebec and Ontario (**Appendix 1).**

Informatics-the capacity to allow for sophisticated mining of level 6 synoptic reporting - as recommended by Canadian Partnership Against Cancer (CPAC) is currently not available, nor planned for.

Adoption of strategies around a provincial strategic plan and funding to leverage the potential of these technological advances is urgently required. A first step should be introduction of strategies for informatics and companion diagnostics similar to those employed by Cancer Care Ontario- this would significantly improve outcomes for cancer patients in this province.

<u>System</u>

Provincial Laboratory Medicine has learned a lot as it moves through the integration process. The system within which it exists, however, needs to also learn. The ability to leverage the maximal potential of an integrated provincial laboratory service can only be achieved if SHA recognizes that Laboratory Medicine *is in fact an integrated provincial laboratory system.*

A truly integrated provincial laboratory system must have complete control of its entire budget, and all of its people. Recent events such as attempts to fill vacant technologist positions in the absence of consultation with Provincial Laboratory Medicine or to re-allocate front-line laboratory staff from COVID-19 testing to health centre screening duty speaks to a lack of understanding as how Laboratory Medicine can achieve maximal beneficial impact for the patients that we serve.

<u>Academic mandate</u>

There are further and more detailed discussions about Education and Research in Sections 4 (Teaching) and 5 (Research) but I would like to emphasize some additional important trends/issues that will have direct impact on the department in the next 5 years.

a. The single largest obstacle to delivering and expanding the departmental academic mandate is the lack of clear expectations in most departmental contracts. The easiest solution would be to move all ‘default’ contracts to the model used in Western University (London, Ontario) with unequivocal articulation that 80% of the FTE is devoted to clinical practice and

20% to academic matters-which are governed by well-defined deliverables.

b. In 2019 the Department successfully obtained some funding from the OVDR to promote department sponsored research that was undertaken by those other than 'professional researchers'. The spirit of this initiative has been captured in a Terms of Reference document (**Appendix 1)** that emphasizes multidisciplinary, distributed research to improve access and health outcomes. It is important that this initiative be supported on an on-going basis. A list of studies under way is also included. It is extremely important that this initiative be funded on an ongoing basis and expanded.

c. It is important that we receive stable funding for an imbedded PhD-trained research coordinator in the Department. Ideally, this individual would be completely devoted to Laboratory Medicine, but even if it had to be shared with another Department e.g. Obstetrics and Gynecology, it would provide significant support for faculty currently actively involved in research, would encourage others not currently involved to explore research options and in the presence of departmental funding prove a stimulus to multidisciplinary and distrusted studies.

d. Currently, the department faces a leadership problem-which manifests in two ways. Recruitment to the department has become more successful as a result of clear identification of provincial needs, effective searches to identify individuals who possess the competencies required to fill those needs and careful selection of the correct individuals who can work effectively for and within the department team. But in future there must be a search for our future leaders and resources (protected time and financial support) will be needed to mentor and train these individuals. Another vital component is the adoption of the practices of Alberta and Quebec-where the leadership component of the FTE is paid at the Clinical Rate.

The second problem is that some excellent department leaders are being excluded from fulfilling their leadership abilities-because they are PhDs-and excluded from positions such as Area Lead, for instance. A temporary work-around has been to promote such leaders to 'interim' positions of leadership and therefore keep this process off the SHA 'radar screen'. This is an issue that needs to be solved in a reasonable fashion as soon as possible.

e. A simple and effective means of improving and accelerating decision-making for the provincial laboratory system would be the implementation of 'go-to persons' for Laboratory Medicine within both SHA and MOH.

f. It is the responsibility of all who work in health care to strive to improve economic self-literacy and literacy within the entire system. Concepts of success on the basis of GDP metrics, a focus on 'costs' in a single component of the operation and 'throughputs numbers' are not valid and actually promote confusion. More sophisticated metrics of societal success such as Human Development index (HDI), Human Sustainability Development index (HSDI) or GINI Coefficient are required. The importance of early intervention as a requirement for optimal outcomes cannot be over-emphasized. Decisions in the area of Laboratory Medicine must be framed as ***'investment'*** as opposed to ***'cost'*** and evaluated in terms of '***system benefit'.***

Comments from Department's Finance & Administration Manager, Mr. Harold Shiffman

As manager of the Department of Pathology and representative for the College of Medicine I have provided my thoughts and insights regarding the current state of the department below.

Patient Care Mandate:

It is my belief, as an observer, that the current point system utilized by the Saskatchewan Health Authority (SHA) is counter-productive to the operation of Pathology and Laboratory Medicine (PaLM). PaLM utilizes the L4E workload guidelines, which are similar to the Royal College system, which has shown to be inherently complex and inconsistent (especially amongst subspecialties). A competing system known as the Warwick system may be worth examining in the SHA (Carr, Sanders, Stores, Smew, Parkes, Ross-Gilbertson & Simon, 2006). I have also observed sub-groups or cliques within the clinical departments which exacerbates the imbalance and makes groups of overworked and unhealthy doctors trying to balance extensive workloads with their academic and research portfolios (not to mention their own personal lives).

Whether a result of the point system or other circumstances, pathologists in Saskatoon and Regina appear to be unable to maintain a balance between clinical expectations and academic or research priorities. This puts the academic program at a disadvantage with residents attempting to earn their Entrustable Professional Activities (EPAs) but receiving little or no opportunity to complete them. As an example, one senior resident in his/her Transition to Practice stage of residency, was provided a pathologist's excess workload. These samples were not a learning experience for the resident and were simple cases the clinician didn't want or have the capacity to do on her own time.

Teaching Mandate:

Clinicians within the Pathology Department have shown an unwillingness to take on residents or to treat them as protégées. The culture created within the unit has made pathologists unhappy, stressed and unappreciative of their place in training the next generation. The influence of the College of Medicine on the Pathology Department is small, as the laboratory medicine section is substantially larger than pathology proper. This has led the SHA to disregard their teaching mandate, with many staff and managers in the health authority treating residents as second class. They are frequently treated with disdain, are not seen either as a resource or an opportunity. That said, it is pleasing to see many good residents succeed within this challenging environment.

Research Mandate:

Staff and resident research are well supported within PaLM, including the distribution of endowment and discretionary research funding on frequent occasions. Research is celebrated across the department and many high-profile researchers are employed. Additional funding would still be beneficial to the department, especially from outside agencies as this would increase the profile of the department's research. I believe PALM would benefit greatly from a staff member who could be dedicated specifically to grant application and other research-related administrative tasks.

Governance, Leadership and Administration:

Currently the Provincial Head is overwhelmed with academic, clinical and public health related work. I believe that the installation of an area lead to manage all the clinical operations of PaLM would help give the Provincial Head more focus toward academic and research pursuits. The Department of Pathology on the College of Medicine side is small, with few staff. It is easy for the needs of these individuals to be missed when managing a large portfolio of staff within the health authority, including both clinicians and technologists.

There also appears to be a lack of policy (or a lack of enforcement) of the academic expectations of clinical staff. It has been mentioned on several occasions that the SHA contracts include an expectation of academic time, but some pathologists refuse to provide this duty. If wording in contracts is vague and unenforceable, something should be done to resolve this issue.

Despite these challenges, the current Provincial Head has taken the opportunity to reinvigorate many leadership committees to ensure transparency, opportunity and input for representatives within the various divisions (including PhD, MD, residents and support staff). The department runs smoothly, and the leadership is one of the best within both the health authority and the college. Additionally, the Provincial Head is conscious of financial restrictions and consults with various stakeholders before making any major decisions. All staff members take safety seriously and appropriate means are in place for reporting incidents should they occur.

References

Carr, R. A., Sanders, D. S., Stores, O. P., Smew, F. A., Parkes, M. E., Ross-Gilbertson, V., … Simon, J. (2006). The Warwick system of prospective workload allocation in cellular pathology--an aid to subspecialisation: a comparison with the Royal College of Pathologists' system. *Journal of clinical pathology*, *59*(8), 835–839. doi:10.1136/jcp.2005.032615

Section 2 – Strategic Planning

Section 2 - Strategic planning

a) *Does the department have a strategic plan*?

Yes, please see below

b) *Who was involved in the last strategic planning process*?

Five initiatives involving multiple stakeholders have led to and informed the development of a provincial laboratory medicine strategic plan (please see Appendix 2). On-going quarterly meetings ensure alignments of plans and continued progress as measured by utilization of common **Objectives**, **Key Results** and **Principles** in the domains of *Culture of Safety*, *Connected Care, Clinical Leadership* and *System Alignment and Integration.*

Initial proposals were presented in a public lecture (02 OCT 2015, JF Magee) which was part of the interview / recruitment process for a Unified Head. This led to an 'all-day' **Department Strategic Planning Retreat** comprising department members from Saskatoon and North Battleford (June1st 2016 Saskatoon). Department members in Regina were invited and one faculty member did attend. Topics addressed included transitioning to practice, career mentorship, leadership, the development of a departmental website, engagement with clinical colleagues and COM, development of a provincial mandate through the lens of the Mission statements of COM and Saskatoon Health Region (shortly after to have been integrated into Saskatchewan Health Authority). Specific **interventions** implemented as a result of this retreat included customized 'on-boarding packages' for new faculty, development of a mentorship program, career guidance of residents and faculty, facilitation of careers in education and research, the development of a SWOT dealing with department research, a request for departmental funding to support research in a manner that aligned with both COM and SHR (subsequently SHA), enhancement of the departmental website and promotion of collaboration and engagement of the department with the College of Medicine and other Colleges (Law, Business, and Veterinary Medicine). Following the announcement of a proposed integrated provincial laboratory model, a series of **Transition Planning Meetings** were held in various sites throughout the Province (Saskatoon, Regina, Prince Albert, etc.) between SEP 2016-OCT 2017, culminating in a **Provincial Strategic Panning Event,** comprising over 80 members of clinical and laboratory staff from across the province (28 NOV 2018 in Regina). This focused on the need for a provincial perspective to future decision-making, the development of discipline specific groups and the support of three mandates - clinical care, public health and the academic mandate. This has been followed by continual refinement of a **Strategic Roadmap** in quarterly joint meetings of the Saskatchewan Health Authority, Provincial Programs and Laboratory Medicine and *within Laboratory Medicine itself* by multiple **Provincial Discipline Specific** and **Functional Groups** meetings. Information to 'front-line workers' is provided by the Executive Director and Provincial Head in person through a series of *huddles* and *town-halls* or by emails with Regular Communication updates and a Provincial 'We Are Lab-spread the News Event in 2019. (**Appendix 2)**

c. *Is the strategic plan in alignment with the college's strategic plan*?

Yes - please refer to the logos on the front page of this Self Study which emphasize

the alignment of COM and SHA Vision, Mission and Values.

The COM Strategic Plan 2017-2022 (**Appendix-2)** lists the following Strategic Direction:

Strengthen research capacity - *leverage expertise and opportunities while performing research across the breath of biomedical sciences, clinical medicine, health systems and health populations to create an environment where research can excel.*

Provincial Laboratory Medicine promotes three equally important mandates - Clinical Care, Public Health and the Academic mandate. It is currently involved in basic science research (undertaken mainly, but not exclusively, by faculty who work in Health Sciences). Given that the Department includes faculty with skills in the areas of Public Health, Infectious Disease, Chemistry, Hematopathology, Transfusion Medicine, Anatomic Pathology, Genomics, Tissue Transplantation, Immunodiagnostics, Health economics and utilization, Informatics, Education and Educational scholarship and Health system design, members of the Department are involved in multiple, multidisciplinary and distributed initiatives. For a full list of projects, please see sections 4 and 5 (Teaching and Research) of this Self Study.

A short list of some on-going Department initiatives that align with the COM strategic plan include the productivity of the already successful Cancer Cluster, implementation of research mentorship for more junior academic faculty (Drs. Mc Nair, Radomska and Uppalapati), collaboration with researchers in the Saskatchewan Cancer Agency, Child and Women's Health (Gynecological and pediatric cancer, implementation of tumor 'banks') Western Canada Veterinary College, School of Pharmacy (Pharmacogenomics),varying educational groups (Sask. Polytech, COM, Luxonic (VR), as an educational tool), University of Calgary and Pathology Solutions (Masters Training for Pathology Assistants), Public Health (implementation of genomic diagnostics in rural locations), many interdisciplinary and distributed initiatives involving digital imaging in anatomic and hematopathology, utilization and appropriateness studies, Choosing Wisely Conferences 2018, 2019 (in association with the Department of CME) that reflect the sentiments expressed in the TOR of our Departmental Research Funding initiative. (**Appendix 2**). Continued access to Departmental Funds, recruitment of an embedded PhD Coordinator and an Informatics Scientist would significantly empower these initiatives. In addition, please refer to the section on education (below).

Education - *enhance quality and methods of teaching learning and scholarship. Focus education and training to develop clinicians that excel at meeting the needs of the province, are culturally competent, and are imparted with leadership ability to drive health system transformation.*

Members of the Department make significant contributions to undergraduate and post graduate education (please refer to section 4-Teaching-for a complete list of Department contributions). The Department currently hosts a General Pathology Residency Training Program but is exploring the possibility to introducing residency training in Anatomic Pathology to achieve better alignment with provincial needs. The GP program is in the throes of moving to a Competence by Design (CBD) model of training. To emphasize the importance of this event and to promote success, the two most recent Department Retreats (02 MAR

2018; 27 MAY 2019) have been devoted to aspects of CBD **(Appendix 2**), members of PGME have also been invited to present on implementation of CBD at both Department meetings and Departmental Grand Rounds. Department members have been encouraged to join the 'Community of Scholars' implemented by Dr. Cathy McLean. To that end, all new hires meet with her and the Vice Dean of Education as part of their 'on-boarding' practice. Department members have been encouraged and supported in attending selected Harvard Macy Courses. To-date, two members have availed of this opportunity and a third is scheduled for 2021. Members have also been encouraged to pursue Masters training in Education; Dr Kalyani Premkumar has been invited to present on this topic at our next Departmental Meeting while one-on-one meetings for selected Department members with Dr Premkumar have been scheduled. An Educational Committee has been implemented and will be expanded to have a provincial mandate.

Social Accountability and community engagement - *Address the priority health concerns of the communities the college is mandated to serve, incorporating authentic community engagement and mutually beneficial partnerships. Focus on equity and community engagement by interweaving social accountability throughout the college's operations.*

Integrated Laboratory Medicine comprises 1500 employees distributed through 200 locations across the province. Our provincial mandate requires that we promote a culture of safety, enhance connected care and develop system alignment and integration to deliver improved access and optimal patient outcomes. The Department engages with individuals who are marginalized or 'at-risk' and who live in urban, remote and rural sites. All require timely access to an enhanced and appropriate portfolio of laboratory testing. Specific examples currently underway include improved access to the diagnosis of infectious disease by rural location of genomic diagnostics, implementation of non-fasting lipid testing, patriation of cancer genomic testing (significantly improved turn-around times), and proposed implementation of newborn screening for severe combined immune deficiency (common in populations who are Mennonite or Northern Cree), enhanced cervical screening (invasive cervical carcinoma is more common in rural and remote areas), and enhanced access to renal disease screening (renal disease is more common with poorer outcome in rural and remote populations). Members of the Department have engaged with Transgendered Patient Groups as they seek to understand their needs and learn to provide a culturally appropriate practice and normal range of values for this group of vulnerable patients.

Social accountability is encouraged within the Department both in residency education, at Department retreats and through Department Rounds. The former Head of the Division of Social Responsibility (Dr. Ryan Meili) presented Grand Rounds (OCT 2016) in association with two Department members involved with international outreach initiatives (Dr Henni Rees-Broken Earth-Haiti; Fergall Magee-COG outreach to Low Income Countries). A presentation was delivered by Dr. Lori Hanson, Director, and Erin Walling, Strategist, Division of Social Accountability at the 30 SEP 2019 Department Meeting.

Between 2016-2019, Dr. Henrike Rees, one of our pathologists, has participated in and co-lead four annual medical missions, primarily intended as surgical initiatives, to a hospital in Port au Prince, Haiti. This team is part of the national

Team Broken Earth, a volunteer task force composed of physicians, nurses and other allied health professionals from across Canada. During these trips, Dr. Rees met on a daily basis with pathology residents and pathologists for formal teaching sessions. Dr. Rees has presented a summary of her experience at Department Grand Rounds with the hope that these presentations stimulate an interest in global medicine.

In 2019, through "Academics Without Borders", Dr. Rees spent two weeks at the teaching hospital for the University college in Moshi, Tanzania to provide education support and material to local pathologists in the management of advanced breast and cervical cancers. In the meantime, Dr. Rees has made herself available as a remote digital pathology consultant for the Kilimanjaro Christian Medical Centre (KCMC) in Moshi.

Initiated by a Department faculty member based in Moose Jaw, Dr. Viktor Skihar, and supported by many individuals and organizations in Saskatoon, a Health Initiative continues to collect medical supplies, medications and equipment for shipment to physicians in Ukraine. To-date, over one ton of supplies have been shipped to six different volunteer organizations in Ukraine.

Indigenous Health - *respond to the calls for action in the truth and reconciliation Report and work in a mutually beneficial and collaborative manner with the Indigenous peoples of Saskatchewan to define and address the present and emerging health needs in indigenous communities.*

Currently we are engaging with a number of Indigenous Groups to provide specific services requested by their communities

1. Screening for renal disease
2. Proposal for pilot study for IgA Nephropathy
3. Implementation of newborn screening for SCID
4. Implementation for Liquid Based Cytology
5. A provincial initiative to enhanced POCT
6. Rural genomic diagnostics for infectious disease (GeneXPRT currently deployed in 17 rural locations)
7. Promotion of cultural sensitivity among faculty (Retreat in MAY 2019- **Unconscious Bias**)

Empower and engage faculty*-focus on support, development and engagement of all faculty members to foster mutually beneficial relationships and empower faculty members as role model for future clinicians and scientists.*

As stated earlier, the first Department Strategic Planning Retreat (01 JUN 2016) addressed topics such as transitioning to practice, career mentorship, leadership development, faculty engagement with the COM. Interventions implemented as a result of this retreat included customized 'on-boarding packages' for new faculty, development of a mentorship program, assignment of content mentors, career mentors, support for educational opportunities e.g. attendance at Harvard Macy Courses, support to attend subspecialist selectives; i.e. dermatopathology selective with Dr Martin Trotter for Dr. Osmond, support for a future pediatric hematopathology selective, support and preparation for promotion, career guidance for faculty and residents with facilitation of careers in education and research, the development of a SWOT dealing with department research, a request for departmental funding to support research in a manner that aligned with both COM and SHR (subsequently SHA) and promotion of cross appointments, promotion of collaboration and engagement of the department with the College of Medicine

and other Colleges (Law, Business, and Veterinary Medicine). In addition the series 'Speaker Series' was created to bring experts for outside of Saskatchewan to promote acquisition of these skills by local faculty-example of speakers include Dr. Laurette Geldenhuys, Dalhousie University (Quality improvement), Dr. Martin Trotter, UBC and Dr. Bev Carter, Memorial (**Medical Error)** and Dr. Bev McLaughlin, Western-(**The 2+1 Subspecialist Model**). Mr. Craig Ivany, CEO Eastern Ontario Regional Laboratories, Jim Slater, CEO Diagnostic Services Manitoba and John Androshuk, BC Laboratory Agency)-**Laboratory Integration.**

Distributed medical education - *Foster a province-wide college. Implement a sustainable, well-resourced framework that will result in quality community partnerships, successful and comparable students across all sites, elevated community health, and better graduate retention in communities.*

UGME-the department contributes to UGME education in Saskatoon and Regina-please refer to Section 4 for greater detail. Please refer to section 4 for more details.

PGME Residents from the General Pathology Program rotate through Saskatoon and Regina. A 'rural' rotation has recently been implemented in Prince Albert. The department also encourages residents to be part of site visits to rural labs by Department Faculty. Resident 'on-call' now includes the provision of a consultation service for rural and remote laboratories. Residents have been involved in strategic planning for laboratory integration.

The Department has funded a multidisciplinary education space in Pasqua Hospital in Regina. This is intended for educational events that include medical students, on and off-service residents and students from Sask Polytech (MLTs, MLAs and CXLTs, Cytotechs and Phlebotomists).

The department offers practicums for Sask Polytech in Sasaktoon, Regina and Rural sites (MLTs, MLAs and CXLTs).

In an attempt to engage with rural sites, the department is currently in the process of beginning to implement a Cellavision network-a digital network to facilitate 'real time; consultation and on-going education and quality improvement in the area of hematopathology (peripheral blood smears). We hope to begin the implementation of this service once the Pandemic has passed. Proposals are currently being prepared for a similar type of technology for use in the world of Anatomic Pathology.

The Department Research Fund has been used to support initiatives that are multidisciplinary and distributed and directed towards vulnerable populations-please refer to TOR for utilization of the Department Research Funding-**Appendix 2.**

d) Is the strategic plan in alignment with the health authority's strategic plan?

Yes. Alignment of the SHA, Provincial Programs and Laboratory Medicine Strategic Plans is assured through utilization of common Roadmaps (Objectives, Key Results and Principles, domains that include Culture of Safety, Connected Care, Clinical Leadership and System Alignment and Integration) and joint quarterly Planning sessions.

e) *Briefly outline any aspects of your strategic plan that differ significantly from health authority and college strategic plans*.

As stated earlier, the use of common language and three monthly joint roadmap reviews ensures ongoing alignment.

f) *Briefly outline any new or emerging factors likely to impact during the coming five years*.

These factors were identified and discussed in Section 1-Update since last Departmental Review.

g) *Briefly outline specific departmental priorities and/or actions attributable to or pursued as a direct result of strategic planning*.

Please see most recent Provincial Programs Laboratory Medicine Strategic Roadmap document.

h) When is the next strategic planning process scheduled to begin?

The department is in a mode of **continual evaluation and development of its strategic plan** by means of monthly meetings of the discipline Specific Groups, to three monthly roadmap reviews involving Provincial Programs and Saskatchewan Health Authority and four monthly meetings of the Laboratory Medicine Provincial Executive Steering Committee.

Section 3 – Patient Care Mandate

Section 3 – Patient care mandate

a. *Briefly outline the clinical services and programs offered by the department and identify whether they are local, regional or provincial in scope*.

Laboratory medicine has been described as 'the science behind the cure' as up to 70% of patient care decisions are informed by some type of laboratory testing **(Appendix 3)**. Laboratory medicine provides health care professionals with information to detect disease or predisposition to disease, confirm or reject a diagnosis, establish prognosis, guide management or monitor efficacy of therapy. Laboratory medicine also plays a leading role in education, research, information technology design and implementation and quality improvement. There are many components within a department of laboratory medicine including **Anatomic (Surgical) Pathology** - the generation of diagnostic information through the analysis of patient tissues (see Appendix 3 – Provincial Planning for Laboratory Medicine), **Hematopathology -** the generation of diagnostic information by analysis of blood cells or coagulation proteins, **Microbiology -** diagnostic methodologies to detect patient infection with bacteria, viruses, fungi, parasites or protozoa, **Clinical Chemistry** - information obtained by analysis of bodily fluids for diagnostic and therapeutic purposes, **Transfusion Medicine -** laboratory practice that encompasses all aspects of the transfusion of blood and blood components including aspects related to hemovigilance, **Genomics** - a branch of laboratory diagnostics concerned with analysis of the patient genome**, Transplantation Medicine (Dr. Marc Baltzan Histocompatibiity (HLA) Laboratory)** - Laboratory diagnostics to ensure optimal match between donor and recipient material, and **Immunodiagnostics** - diagnostic methodology to analyze patient antigens and/or antibodies.

Over the past two years, laboratory medicine in Saskatchewan has begun a process of transition into a single integrated clinical service. Currently this entity comprises over 200 locations, 1500 individuals, performs approximate 25 million tests per year and has an annual budget in excess of $150 million dollars. The structure is one of 'Hub and Spoke' based around the two largest centres - Saskatoon and Regina - includes intermediate sized centres such as North Battleford, Prince Albert and Moose Jaw, but also includes much smaller rural and remote centres, some of which function only as blood collection sites. Not all sites provide all services but the integrated system provides laboratory diagnostic services to the entire province in the following areas: Anatomic (Surgical Pathology), Hematopathology, Transfusion Medicine, Microbiology, Biochemistry, Genomics (Cytogenetics and Molecular diagnostics), Transplantation Medicine, Immunodiagnostics and Public Health (primarily, but not exclusively, located in Roy Romanow Provincial Laboratory). The services are provided for the areas of acute clinical care, chronic care, child and maternal health, primary health care and public health. The 'workforce' providing this care comprises Medical Laboratory Technologists (MLTs) and Medical Laboratory Assistants (MLAs) in larger centres with Combined X-ray/Laboratory Technologists (CXLTs) and MLAs in smaller more rural sites, and currently 69 clinicians - 64 of whom are based in Saskatoon and Regina. The majority of these individuals are MDs but up to 30% are PhD clinicians who work in areas such as Microbiology, Biochemistry or Genomics. Currently five MD pathologists are located outside of the two larger

centres - two in Moose Jaw, two in North Battleford and one in Prince Albert.

Anatomic Pathology diagnostics are provided in five centres (Saskatoon, Regina, North Battleford, Prince Albert and Moose Jaw) with sub-specialist expertise in dermatopathology, breast pathology, gynepathology, GU pathology and pediatric pathology located in Saskatoon and neuropathology and renal pathology expertise located in Saskatoon and Regina. Microbiology testing is performed at North Battleford, Prince Albert, Tisdale, Yorkton, Weyburn and Moose Jaw but clinical expertise is confined to Saskatoon (RUH) and Regina (RGH and RRPL) with both of these cities providing clinical support to the other sites in the province. Transfusion Medicine testing is performed at 22 sites (15 "basic testing", 5 "advanced testing" and 2 "complex testing") around the province but clinical expertise is confined to Saskatoon and Regina – with clinicians in these centres providing consultation expertise to the entire province. Genomic testing is performed at only two sites - Saskatoon and Regina. Tumor signature testing (companion diagnostics) occurs only in the Advanced Diagnostic and Research Laboratory in Saskatoon while cytogenetic analysis (g-banded karyotype analysis) occurs only in the Human Genomic Laboratory in Royal University Hospital in Saskatoon. HLA typing for transplantation medicine occurs only in Saskatoon (SPH) while Prenatal and newborn screening occurs only in RRPL in Regina. Some testing in the areas of Hematopathology and Chemistry had traditionally been performed throughout the province prior to integration. This occurred in the absence of any clinical oversight - a practice associated with significant risk. The diagnostic divisions across the province have been organized into Provincial Discipline Specific groups tasked to identify service gaps and provide solutions that work in a provincial context (see Appendix 3 for examples of DSG TOR and planning).

b) *Describe any challenges and issues negatively impacting the department's ability to provide expected clinical services according to the following areas*:

i. Clinician resource planning

A proposal for an initial integration of anatomic pathology, a decline in anatomic pathology resources for the province, and proposed development of a provincial human resources plan for AP based on the L4e metric which is being implemented in Saskatoon and will be extended to Regina. Currently there are 20 FTEs in anatomic pathology in Saskatoon with the planned arrival of one more subspecialist in JUL 2020 (Dr. Nick Baniak) and four more in 2021 (Drs. G. Wright, J. Vuong, K. Campbell, R. Campbell) and one in 2022 (Dr. A. Andrews). Recruitment is also underway in Regina and Prince Albert. There have been four recent hires in Hematopathology (Drs. Taheri and Jafari in Saskatoon; Drs. Benade and Naidoo in Regina) and recruitment is currently underway for three vacancies in Chemistry. In addition, workload assessments by an external expert are planned for Hematopathology (Dr. R. Maung) and Biochemistry (Dr. Dan Holmes). A request to fund two new positions in General Pathology to support rural and remote laboratories in both the north and south of the province was submitted to the Ministry of Health in Summer of 2019 was submitted to the MOH in summer of 2019. Discipline Specific Groups have been created for AP, Transfusion Medicine, Microbiology and Genomics. These provincial groups have been tasked with analysis of 'current state' in their areas of expertise with recommendations for future needs. **(Please see examples of their work in Appendix 3).**

ii. Physician recruitment and retention

The Department is aggressively in constant recruitment mode. It hosts a Saskatchewan night at our National Conference (Canadian Association of Pathologists) and has recently conducted a similar event at the CAP-Hosted Resident Review Course (Toronto, JAN 2020). These efforts, however, are complicated by the requirements for rural and remote practice mandated by SaskDocs and the Ministry of Health in the absence of communication with the leadership of provincial laboratory medicine.

Changes to contracts offered to recent MD hires in Regina have proven an obstacle-while the status and remuneration of PhDs is a serious problem **(*please see later-section ix)***

iii. Maintenance of and support for diversity in the physician work force

The Department adheres to the same policies that govern equitable hiring practices within SHA and COM. We currently boast a very diverse group of Laboratory clinicians with greater than 50% female representation, from at least 14 nationalities. Unfortunately, there is currently no self-identified indigenous representation amongst our faculty. Our hope is that with ongoing equity recruitment programming at the COM, there will be a larger pool of applicants to the residency program and interest from students with indigenous ancestry to join our Department.

iv. Generalist, specialist and subspecialist clinical service gaps

Both larger sites (Saskatoon and Regina) are moving to a subspecialist model while the practice in the three smaller sites is more of a generalist model. Saskatoon has a more developed subspecialist model with fellowship-trained individuals in the areas of neuropathology, pediatrics, genito-urinary pathology, breast pathology, dermatopathology, gynepathology, while Saskatoon and Regina have individuals with fellowship training in cytopathology and renal pathology. In addition, Saskatoon has more individuals with extra training in Transfusion Medicine, immunodiagnostics, tissues transplantation, cytogenetics. Both sites have chemists with additional training in Tandem Mass Spectrometry, and Education.

v. Clinical service gaps related to access and wait times

'Turn-around times' (i.e. the time between accessing a patient specimen and providing a final diagnostic report) in Anatomic Pathology have been a challenge throughout the provincial system. This led to a review and report commissioned by government auditors **(Appendix 3)** resulting in the creation of two additional AP positions (one in Regina, one in Saskatoon) but currently recruitment is a challenge. This topic is also referred to in the document entitled- **Annual Review of Quality Management system-April 2018-March 2019 (Appendix 3).**Currently there are 10 vacant AP positions in the province although Saskatoon will hire six individuals in the next three years and active recruitment is currently underway in Regina, Prince Albert and North Battleford. A further complicating factor is the current (national) shortage of Pathology Assistants - skilled individuals who perform most of the gross dissection and examination of surgical specimens. The province has recently signed a memorandum of understanding with the Masters Program for Pathology Assistants in the University of Calgary and is about to sign a contract with a commercial entity (Pathology Solutions)

to develop a plan for a sustainable pathology assistant service in the province **(Please see Appendix 3)**.

The Clinical Chemistry service has just been informed of two imminent retirements (Drs. Mali and Eichhorst) and is actively trying to recruit to this service- with candidate interviews occurring in FEB and MAR 2020. Recruitment is also underway for two vacant Microbiology positions (one in Saskatoon and one in Regina), the vacancy in cytogenetics will be filled with the arrival of Dr Nawaz in July 2020, and an external review of workload needs for both Chemistry and Hematopathology is planned.

vi. Clinical service gaps related to inadequate or absent facilities or equipment

The single greatest constraint for all of laboratory services is the lack of an adequate Laboratory Information System (LIS). Different iterations of the current system (SOFTPath) exist in the former regions - which are unable to communicate with each other. A further complication is the role and culture of eHealth. The Laboratory system requires that eHealth provide solutions that are required for optimal patient care while eHealth sees itself as the body which determines the needs of laboratory medicine and has displayed reluctance to respond to the requests from the leaders of laboratory medicine. Currently, issues with order entry, server stability, intra-system connectivity and access to the patient portal all display significant risk and require urgent solutions.

Data mining to enhance practice by means of utilization analysis is not possible. One area in which improvement could be affected immediately is that of Cancer Care. Synoptic reporting is employed by Anatomic Pathology but the data cannot be accessed other than by manual analysis. The solution is to adopt the practice of cancer Care Ontario. All synoptic reports enter Ontario through the Cancer Agency-where coding is added by CCO to allow for rapid mining performed by CCO itself at the request of the diagnostic laboratories. SCA does not provide this type of support for the Saskatchewan Laboratory system.

Genomic diagnostics is an area with significant gap in resources. This technology is revolutionizing diagnostic medicine, with implications throughout laboratory practice (please see Provincial Genomics Discipline Specific Report)**,** but no clear strategy as to how to leverage and resource this technology exists. An example of the 'ad-hoc' approach to this technology is shown by the introduction of increasingly more expensive cancer therapeutics while no funding is provided for the genomic testing (a fraction of the drug costs) required to identify the correct population of patients who will benefit for this therapy (**companion diagnostics**). There is also no strategy to deal with expanded prenatal screening, newborn screening, metabolic diseases, pharmacogenomics or the many other areas now dependent on genomic testing (Please see Provincial Genomics Report later in this Section).

vii. Specialist-generalist-primary care communication and collaboration gaps

Laboratory Medicine across the world is moving to forms of integration and consolidation and a sub-specialist practice. Small group practice has been reduced and those remaining have been integrated with larger groups, fully participate in quality assurance activities and have full access to specialty practice. Prospective second opinion is now standard of care in most centres. Integration as is occurring in Saskatchewan will lead to improved

practice and patient care but would benefit of implementation of digital pathology to further enhance practice and care. Digital telepathology refers to the use of telecommunication to transmit pathology images between differing locations for the purpose of diagnosis, education and research. This practice is widely used in the areas of surgical pathology, hematology and microbiology. We are currently engaging with many Foundations around the province to introduce a digital telepathology network for the areas of hematopatholoy and microbiology to connect Saskatoon, Regina, Moose Jaw, Swift Current, Yorkton, Prince Albert and North Battleford. This topic as it applies to Anatomic (Surgical) Pathology is addressed in the submission entitled '**Limited Surgical Pathology Provincial Review'. Please see this report from Dr. Alport later in this Section.**

viii. Clinical services planning, organization, coordination and funding

The integrated Laboratory system in Saskatchewan has a well-coordinated plan as to what is required for accessible and optimal laboratory diagnostics for the population of Saskatchewan. As stated earlier in Section1-Financial Support-'*The absence of secure and sustained funding to enable evidence based* ***staged growth*** *of laboratory diagnostics-required to fulfill our growing clinical, public health and academic mandates-has led to our current state of* ***relentless crisis*** *and* ***repeated reactive interventions.****'*

ix. Clinician clinical payment structures

There are two serious issues in the area of contracts that act as disincentives.

The implementation of recent MD contracts represent a disincentive. Practitioner Affairs/Human Resources seem to be moving away from offering an employee type contract to one of an 'independent contractor'. This is less attractive to current cohort graduates - and on a number of occasions, candidates have refused to come to Saskatchewan and have sought employment in other jurisdictions such as Alberta and BC. In addition, recent MD contracts in Regina have offered less remuneration and time off. This has been raised with Rob Gentes and Jackie McKee at a recent meeting (27 FEB).

The second is around the treatment/payment of our clinical PhDs. I do not think that SHA fully understands that up to 1/3 of clinical staff in the laboratory are not MDs but PhDs. To-date, all clinical staff in the areas of Anatomic (surgical pathology) and Hematopathology are MDs, but a significant number of those who work in the areas of Chemistry, Microbiology, Cytogenetics, Genomics or HLA are PhDs. For example, there are three MD Microbiologists in the province but five PhD Microbiologists. There are currently two MD Biochemists (shortly to be one) but there are six PhD Biochemists. The current SHA Draft Bylaws do not recognize their existence, and all have been excluded from leadership positions such as an Area Department Lead. Saskatoon recently advertised a position as Area Department Lead. One of the PhD microbiologists in Saskatoon applied for this position. This individual had actually functioned as an extremely successful 'Acting Unified Department Head' for approximately five years (2011-2015) but was asked to withdraw his application for the Area Department Lead position. This approach excludes approximately one third of laboratory Clinical Staff from Leadership - a less than ideal circumstance given that eight extremely dynamic leaders in Laboratory medicine are PhD, by training.

An additional complicating factor is that Saskatoon deals with its PhDs through Practitioner Affairs while Regina allocates them to Human Resources. Saskatoon provides more CME time and financial support than Regina. I feel that this treatment is undignified and a disincentive to recruitment.

a) *Describe how the department is addressing gaps, issues and challenges as outlined in the previous question*.

As a result of integration, clinicians who work in the areas of Hematopathology and Chemistry in Saskatoon and Regina are faced with an increasing volume of requests for support from rural and remote laboratories. This is particularly acute in the area of these two groups as many more sites perform diagnostic testing in these areas-in the absence of clinical oversight. Therefore, the provision of clinical support for these diagnostic services in rural and remote areas represents a significant challenge for Saskatoon and Regina. The capacity to successfully implement this initiative will require a significant increase in human and technological resources - *please see comments from The Hematopathology & Biochemistry Discipline Specific Groups.*

b) *Describe specific mechanisms the department employs to ensure that clinical services are high-quality and that quality improvement remains paramount*.

Laboratories are subject to licensing and frequent accreditations. This has led to the development of a strong 'quality culture' and the implementation of a quality management system QMS. Examples of the QMS not being extended through the province and of agendas, minutes and regular quality reports from sites, divisions and provincial groups are provided in **Appendix 3**. 'Spread the News' was introduced in 2019 and is intended as an annual event to celebrate and spread quality improvement initiatives from the entire provincial system.

c) *Describe quality improvement work department members have undertaken that led to changes in the way clinical care is provided locally and/or nationally*.

Local

1. The integration of Laboratory services in the province into a single system (as recommended by the Kendall Report (see Appendix 3) is designed to provide seamless and optimal patient care.

2. Specific Initiatives

a. The promotion of a 'quality culture' and introduction of a Quality Management system.
b. The implementation of a tissue tracking system in Anatomic Pathology.
c. The on-going patriation of "companion diagnostics" (genomic interrogation of malignant tumors to determine optimal treatment) provides greater access, with significantly shorter turn-around times for patients of the Saskatchewan Cancer Agency (please see also report from Dr. Mary Kinloch, Division Head, Anatomic Pathology and Co-Leader for Provincial Anatomic Pathology Discipline Specific Group).
d. The implementation of Rapid Aneuploidy Diagnosis (RAD) to provide parents with access to timely diagnosis of aneuploidy (Trisomy 21, 18, etc.).
e. The implementation of the Prevention of Alloimmunization in Mothers of Saskatchewan (PRAMS) – repatriating all provincial prenatal transfusion testing from Canadian Blood Services in Vancouver to Regina, Prince Albert and Saskatoon (please also refer to the Transfusion Medicine report from Dr. Sheila Rutledge Harding).

National

a. The development of rigorous quality assurance methodology in the areas of immunohistochemistry and biomarker utilization.
b. Implementation of molecular diagnostics in gynepathology.

Please refer to reports from Transfusion Medicine and Anatomic Pathology later in this section and to Appendix 3.

d) *Describe specific mechanisms related to maintaining and improving patient safety*.

Please refer to reports later in this Section from Drs. Kinloch, Alport, Blondeau, Torlakovic, and Rutledge Harding. Please also refer to Spread the News in Appendix 3.

e) *Describe specific mechanisms that ensure clinical services are responsive to patient needs*.

Various sections of the Laboratory have patient input through inclusion of patient representatives, patient meetings (Anatomic Pathology and townhalls (Executive Director, Provincial Head)) and/or carry out regular patient surveys (Blood Collection, Roy Romanow Provincial Laboratory). In addition, there are multiple huddles – local, divisional, provincial and multidisciplinary – to review departmental practice operations, academic issue and patient safety concerns.

f) *Describe any clinical programs or initiatives designed specifically to address the needs of socially marginalized or vulnerable patient populations*.

Please see list of initiatives discussed in **Section 2** under the headings of '**Social Accountability and community engagement'** and '**Indigenous Health'**.

g) *Identify how department strengths will assist in addressing any trends, opportunities, or challenges that lie ahead with respect to the provision of expected clinical care*.

The Departmental response to the COVID-19 pandemic speaks to significant strengths to enable future success based on a well-trained, collaborative team with multiple skill sets, determination and dedication – allied to flexibility, innovation and resilience. They engage with the three department mandates of acute patient care, public health and academics. Individuals are collegial and share a strong commitment to optimize laboratory access and provide strong support for rural and remote patients. Discipline Specific Groups are committed to a provincial perspective – which has only grown stronger during the pandemic. Various members have skill sets in the areas of Genomics, Quality Improvement, Patient Safety, Basic or clinical research and education and there is a deep commitment to social accountability and advocacy. Leaders are being mentored to ensure future assured success.

COMMENT on COVID-19

At approximately 8:00 p.m. Saskatchewan time, 31 DEC 2019 (New Years Eve), a Chinese government website announced the detection of 'pneumonia of unknown cause' in the area surrounding the South China Seafood Wholesale Market in Wuhan, an industrial city of 11 million in the province of Hubei. The outbreak was one of a least a dozen confirmed by the World Health Organization that December, including cases of Ebola in west Africa, measles in the Pacific and dengue fever in Afghanistan. Outside China, no one paid much attention to the news from Wuhan.

Over the next 170 days (at time of writing) the disease spread throughout the world, froze international travel, extinguished economic activity and confined over half of humanity to their homes. A Public Health Emergency of International Concern was issued 30 JAN 20 and a Pandemic declared 11 MAR 20. Along the way, the virus acquired a name (COVID-19, 11 FEB 20) and infected millions. Among them, the Vice-President of Iran, the actor Idriss Alba and the British Prime Minister, Boris Johnson. As of 17 MAY 20 the WHO website lists 4, 534,731 confirmed cases of COVID-19 infection, 307,537 deaths and infection in 216 countries, areas or territories. Saskatchewan acquired its first case 12 MAR 20 and now on 17 MAY 20 reports 592 confirmed cases, 444 recovered individuals with 6 deaths.

Diagnostic testing for COVID-19 is by means of a genomic platform to detect viral RNA from suspect patients. In early MAR, the Laboratory service performed 5-10 tests per day and by the end of APR had capacity to perform 1500 tests per day. Testing is performed on a variety of genomic platforms located in Regina, Saskatoon and in seventeen rural and remote locations around the province. The bulk of testing is performed in Roy Romanow Provincial Laboratory (RRPL), (1000 + tests), with almost 500 tests per day currently performed in Molecular Microbiology in RUH, Saskatoon. A smaller number of tests are being performed in the rural sites - on a platform called GeneXpert; these sites have less capacity that the bigger centres, but implementation of this platform is easier, test run is shorter (< 2 hours as opposed to 6 hours on larger instruments) and travel time is significantly shortened.

Upscaling of this test strategy has involved training of almost 100 laboratory staff, numerous instrument validations and almost daily battles to obtain reagents as diverse as nasopharyngeal swabs, universal transport medium, and extraction chemicals and genomic probes - while still dealing with testing from non-COVID-19 acutely ill patients. The laboratory now faces four significant demands - continued increased utilization of COVID-19 diagnostic testing, a request to begin population surveillance testing through utilization of serological technology, increasing demands for testing on the non COVID-19 population as SHA begins resumption of more expanded services, and a concurrent increase in demand for blood products.

I wish to commend the entire laboratory team who have been involved not only in COVID-19 testing but also in the planning of multiple areas of Surge Response and resumption of service. In happier times, we will celebrate appropriately this truly amazing work!

Anatomical Pathology
Dr. Marilyn Kinloch, Division Head
12 MAR 2020

a) *Briefly outline the clinical services and programs offered by the department and identify whether they are local, regional or provincial in scope*.

The Anatomic Pathology division in Saskatoon encompasses surgical pathology, neuropathology, dental pathology, cytology (both gynecologic [pap smears], medical, semen analysis), and autopsy services that are provided locally for surgical pathology from all three hospitals, family medical clinics and all specimens generated in outpatient or private surgical clinics.

Regionally; autopsy, neuropathology, immunohistochemistry and cytology services are provided (the entire northern part of the province).

Provincially, our lab at Saskatoon City Hospital is the reference center for patient predictive biomarkers for cancer testing. This would include PDL-1, ALK-1, and ROS-1 for lung cancer testing and endometrial MMR testing. All renal biopsies are processed in our laboratory and electron microscopy services are provided from St. Paul's hospital provincially.

Local	Regional	Provincial

• Surgical Pathology
  • SPH, RUH, SCH operating rooms
  • Family medicine clinics
  • Hospital out patients
  • Private surgical clinics
	• subspecialized surgical pathology service
	  • dental
	  • neuro
	• Immunohistochemistry
	• Cytology
	  • papsmears
	  • medical cytology
	• autopsy pathology
	• semen analysis
		• predictive biomarkers
		• renal pathology
		• electron microscopy

Describe any challenges and issues negatively impacting the department's ability to provide expected clinical services, according to the following areas.

i. Physician resource planning

Improvements have been made over the last few years with physician resource planning by using specialty workload metrics to decide recruiting priority. We have

recruited pediatric, gastrointestinal, dermatologic pathologists in this regard and have a resident recruitment succession plan. For the first time we have begun to use leadership experience as a discriminating feature for hire, aligning with the Saskatchewan Health Authority goals. We have begun the discussions of a provincial recruitment plan, but it is still unclear how we integrate smaller regional pathology practices optimally.

ii. Physician recruitment and retention

The Department and division have focused on targeted recruitment of graduating residents for the last 3 years. We have recognized the futility of passive advertisements and recruiting mid-career people and have focused efforts on young, enthusiastic residents transitioning to practice. This has been accomplished by attending resident review courses and annual meetings of pathologists and hosting residents and engaging them on a personal level. This has resulted in us hiring 3 pathologists in the last 2 years and 6 pathologists in the next 2 years. The biggest obstacle in physician retention is offering something other than staying in Saskatchewan for family reasons or that Saskatoon is a low-cost place to live with a relatively high wage. We haven't quite figured out what we do better than everyone else to sell, but it is fair to say that we have a high-quality laboratory. The recommendation is that we build a niche in both the medical school, post-graduate training and clinical work that interested subject matter experts desire to stay here for.

Sometimes it has been difficult to recruit into the rigidity of open positions. Often times, we know of an upcoming retirement or someone is planning on leaving, but the position cannot be recruited into until the person leaves. In the best of circumstances, we would be able to advertise, interview and fill a position with an overlapping presence for orientation.

The future of pathology, no doubt, lies within digital pathology. For us to continue to retain high-quality subspecialties with our volumes (see IV) it would be ideal to have a digital pathology platform to connect subspecialists with other subspecialists across Canada. This would aid in the retention of our subspecialists that are often "solo" pathologists.

iii. Maintenance of and support for diversity in the physician work force

This is generally not an issue in pathology. Our physician workforce represents over 10 countries and our residency program is equally diverse.

iv. Generalist, specialist and subspecialist clinical service gaps

Our physician subspecialist recruitment strategy has been successful, with the exception of two areas: pulmonary pathology and soft tissue pathology. Even if we funneled all the patient material to one subspecialist there would still not be enough material to recruit a subspecialist to keep their expertise up. We end up being in this interesting limbo where Saskatoon is the reference center for soft tissue surgeries provincially, but not enough volume to continue subspecialty proficiency. The solution may be to provincialize this service and combine all of the material from Regina and Saskatoon together for these select areas and this could go into the physician provincial resource plan.

One aspect I will bring up here is the clinical service gaps that have historically been with medical genetics, metabolics and molecular pathology. These haven't been under the department of pathology and laboratory medicine. Given how integrated they are with Anatomic Pathology, it has been difficult having them outside of our provincial program and I believe contributes, in part, to their difficulty in recruitment.

v. Clinical service gaps related to access and wait times

We have had historically struggled with wait times in the laboratory that has been due to work force fragilities at all levels of the lab. We monitor wait times weekly and have measures put in place if the wait time reaches a threshold we consider unsafe for patients and pathologists.

Currently, the average wait time for a pathology report is 13 days (including weekends). We utilize metrics to break down where in the laboratory the delays are occurring. We also have a proactive triage system in place that if a clinician requires the result expeditiously. It would be ideal to be able to break down the metrics even further to design interventions for specific delays, which can lead into the next component.

vi. Clinical service gaps related to inadequate or absent facilities or equipment

Probably the biggest gap clinically is the support of our quality assurance/quality improvement system. We have amazing talent in place for these initiatives but we struggle with providing visual representation of what we are doing; run charts, updated spreadsheets, report cards. This could almost exclusively be rectified with a Level 6 synoptic reporting solution. The lab readiness for this is high but is waiting on Cancer Agency readiness for the IT solution. From this, we could query and monitor almost any metric automatically.

For a long time, the Saskatoon laboratory functioned by sending specialized testing out of province. This has been a fundamental paradigm shift in the last 5 years but is a monumental task in some areas and has funding implications (see viii). All of our cancer genetics are run outside of Saskatchewan Health Authority. We do not have the equipment to extract DNA or RNA, no ability for amplification or sequencing for cancer. This is critical for most precision medicines. We have made huge strides in utilizing the Advanced Diagnostic Research Lab, which is run by a University of Saskatchewan dermatopathologist, that works in SHA and I act as the solid tissue liaison, but would better served if we were able to merge the two formally. The lack of ability in the DNA and RNA extraction precludes us from also having a formal tumour DNA bank, which is the foundation of any outcomes research in which University researchers would be interested.

The future of pathology is in digital pathology. We need to be proactive that telepathology platforms would connect and support all the laboratories in the province and then connect our subspecialists to the national experts. The department head is very supportive and we are working through an anonymous donor to make this a reality.

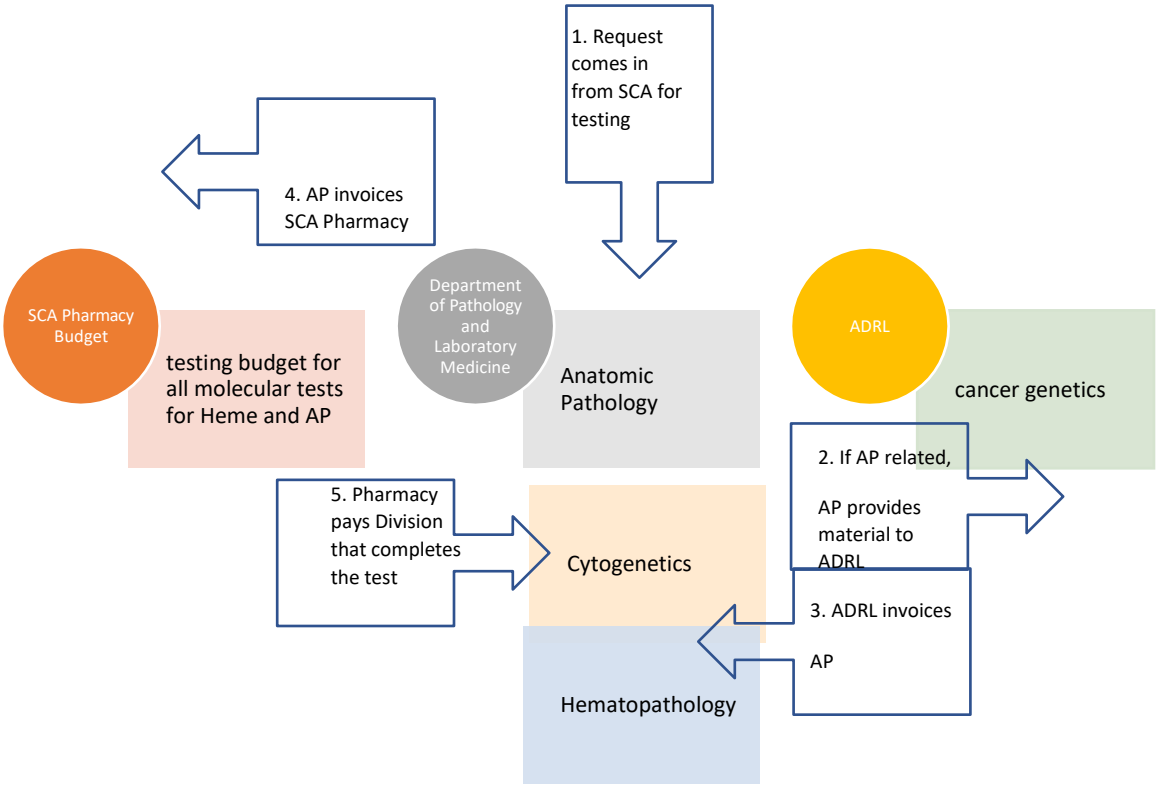
vii. Specialist-generalist-primary care communication and collaboration gaps

This isn't really a problem for pathology.

viii. Clinical services planning, organization, coordination and funding

Siloes of funding result in a majority of barriers for us. The first hurdle arises from the fact that, largely, the testing budget for molecular testing comes from the Saskatchewan Cancer Agency pharmacy budget. This has historically been the case because most of this testing is tied to a specific therapy. Because Anatomic Pathology processes this material and ships it to ADRL, ADRL invoices Anatomic Pathology and then Anatomic Pathology invoices the SCA pharmacy budget. Anatomic Pathology, however, does not have control over the funding that is approved for testing or its indications.

Secondly, testing for certain mutations can be done in multiple different platforms or methods. These platforms can reside in different parts of the lab, and in a different budget. This can make it difficult to change the testing platform, even to make something more sensitive or efficient because it involves transferring budget.



ix. Physician clinical payment structures

This is not a current issue for Saskatoon Division of Anatomic Pathology.

b) *Describe how the department is addressing gaps, issues and challenges as outlined in the previous question*.

I have included the specifics in the previous paragraphs.

c) *Describe specific mechanisms the department employs to ensure that clinical services are high-quality and that quality improvement remains paramount*.

Our lab is proud of their robust quality assurance program that ensures quality in every step a patient's tissue makes its way through the lab to present the highest quality product to the pathologist for interpretation. We recently passed the stringent western Canadian D AA that has over 400 accreditation standards we passed. In addition to having a stellar product that happens from our quality assurance, we recognize that our pathologists need to embrace quality assurance to bring trust to the system that relies on interpretation. Therefore, we have numerous mechanisms in place to promote quality into our diagnostic interpretation.

Additionally, we have a divisional surgical pathology and separate cytology quality assurance program. All pathologists are invited to become members of either group. We have a streamlined process for requesting changes that pathologists, or anyone in the lab can suggest and a forum that involves every level of the lab in discussion on how this will impact them and what changes need to occur to make the change request a reality.

We have developed provincially standardized quality metrics that we report on a provincial level to the discipline specific groups. This would include metrics such as frozen section correlation, case look-back prevalence, and prevalence of patients presented at tumour board rounds.

a. Describe quality improvement work department members have undertaken that led to changes in the way clinical care is provided locally and/or nationally. Two division members in Anatomic Pathology have taken the Clinical Quality Improvement Program (CQIP) that is provided by the Saskatchewan Medical Association and Health Quality Council. The role of CQIP is to promote physician leadership in continual quality improvement. One pathologist did a project on improving the subspecialty metrics of the breast service. The success out of this project improved turnaround times, communication in the lab and moved to a pull system for case distribution instead of a push system.

The second pathologist had a project related to improving biomarker success and turnaround time. This resulted in a turnaround time improvement from 4 weeks to less than 8 days, success from 67% to 100% and a cost savings. This was also a success in that it is one of the biomarkers that we repatriated back from Alberta that we are now performing in province.

Our cytology team took on the task of validating this special biomarker testing for cytology specimens to improve patient care. It was excluded from testing because of the tissue exposure to cytolyte, but endoscopic ultrasound biopsies are much safer and less invasive for the patient, so they developed a pathway to validate the biomarkers using cytology specimens.

We have brought in universal mismatch repair testing for colorectal, endometrial and ovarian testing which screens for hereditary cancer testing. This reduces the burden on medical genetics, shortens wait times and most importantly proactively identifies patients and their families that may require high risk surveillance or testing.

e) *Describe specific mechanisms related to maintaining and improving patient safety*.

Our patient safety rounds are central to our culture of patient safety in the laboratory. These are volunteer presenters who bring forward cases or situations where the outcome was a near miss or involved patient harm and brings it as a learning opportunity for the rest of the pathology team. We invite technologists and clerical staff to these rounds as usually they find the information helpful and useful. We rely on our culture of safety to have pathologists self-identify to present these cases. An example of patient safety rounds is attached.

Other times we have used patient safety rounds to go over one of the provincial metrics; such as intraoperative correlations, where we gather and actually run through the intraoperative frozen sections we had for a period of time, when we know the final diagnosis and where potential pitfalls can happen.

Our breast group has integrated with our grossing technologists to develop a grossing checklist so that every breast has its own version of a surgical checklist when it arrives that includes, number of tumours, location, previous clips from biopsies so the most accurate diagnosis can be given to the patient.

The division of Anatomic Pathology has a state-of-the-art specimen tracking system that was provided by an anonymous donor. This tracking system allows every block of tissue and every slide to be located using a computer monitor. Previously if blocks of tissue were misplaced or misfiled technologists would spend hours looking for this precious tissue. It also promotes safety as a positive ID match must be made when putting tissue into a block or onto a slide. Labels are printed as needed and not pre-printed also cutting down specimen mix-ups.

f) Describe specific mechanisms that ensure clinical services are responsive to patient needs.

We have a unique committee, the Biomarker Development and Quality Assurance Committee that spans across oncology, cancer pharmacy, dermatopathology, molecular pathology and anatomic pathology. We have representation from physicians, pharmacists and managers to ensure that ideas become operational.

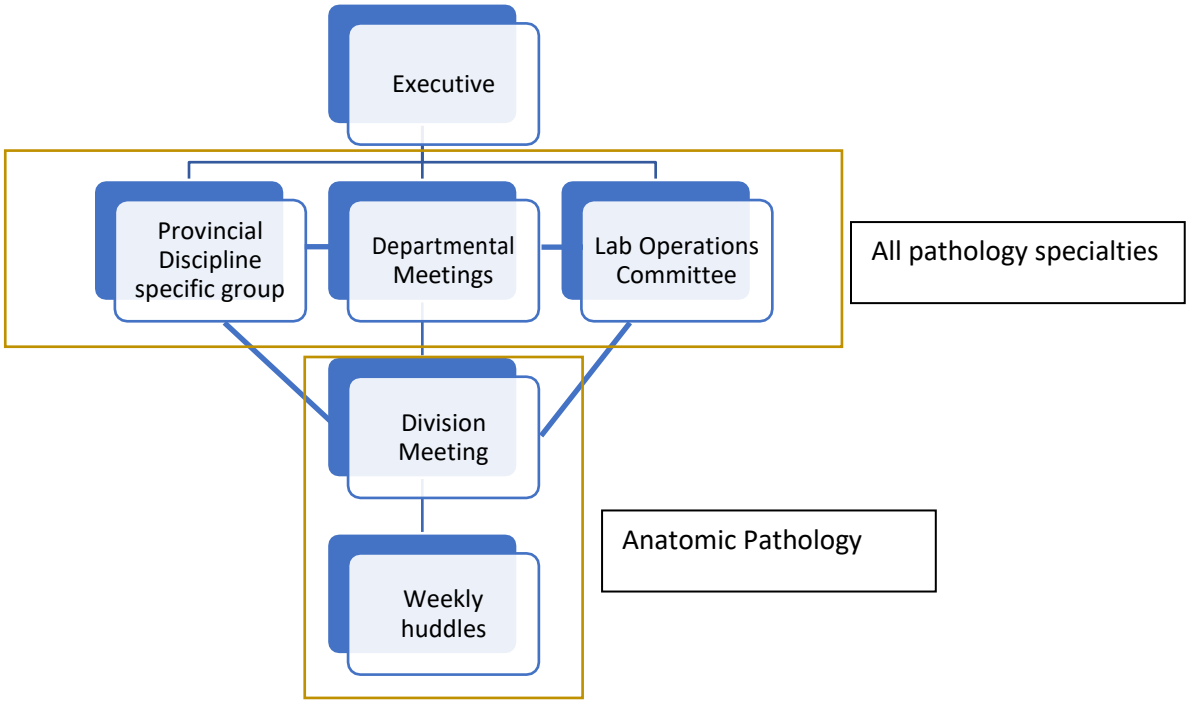
a) *Describe any clinical programs or initiatives designed specifically to address the needs of socially marginalized or vulnerable patient populations*.

Arguably, pathology is the most objective specialty because we do not have the same biases in place that other specialties have.

There is a goal that with the new liquid-based cytology initiative that we will be able to promote self-collection for women that cannot access physicians or nurse practitioners for pap smears.

h) *Identify how department strengths will assist in addressing any trends, opportunities, or challenges that lie ahead with respect to the provision of expected clinical care*.

The department of pathology and laboratory medicine has an anastomosing organizational structure so that any trends, opportunities or challenges are shared intra-divisionally, inter-divisionally, and cross-divisionally through the province.



Anatomical Pathology
Drs. H. Rees, J. Benoit, C. Wang, D. Ravi, D. Yu, T. Banerjee, L. Quenneville, A. Osmond
03 MAR 2020

Challenges:

- Persistent chronic lack of manpower
- Burnout of pathologists
- Lack of equipment (lack of thin prep Pap test, good reliable cameras, appropriately sized multi head microscope at City Hospital, frozen section microscope at City Hospital, stage clips for existing microscopes)
- Centralization of services at Saskatoon City Hospital
- Lack of adequate office space (some of the new offices are small, windowless and a long way from other pathologist's offices)
- Changing personality dynamics among staff
- More daily disruptions to pathologists who have worked at SCH for a long time
- Lack of multi head microscope space
- Lack of clerical support
- Pathologists need to type reports or use voice recognition to replace transcription services
- Pathologists now need to electronically access information which was previously provided by clerical staff (retrieving old pathology reports or operative report)

- Pathologists need to scan slides into their offices
- Subspecialization
    - Not enough material for some specialties
- Communication issues between pathologists and pathologists and/or clinicians (medical liver (lack of available or easily accessible clinical history), inflammatory dermatoses and melanocytic lesions)
- Workload system currently in use (does not take case complexity of certain specialties into account, does not allow easy adjustment and contributes to perception that service is valued more than other contributions in anatomic pathology)
- Young dynamic Division Head lacks reliable, consistent, administrative support
- Division Head is busy and it is often difficult to find time with her to have a calm, unhurried conversation

Gains/victories:

- Tailored recruitment (subspecialty specific)
- Hiring of new young specialty trained pathologists and former residents (Is this due to aggressive recruitment by Division Head and Provincial Head including events such as recruitment dinners at national pathology conference and resident review courses? What is the financial cost of these events?)
- Departmental focus on improving education
    - Regular pathology grand rounds
- Patient's safety rounds
- Repatriation of specialty tests (lung bio markers, HER2 gastric)
- Centralization of services at Saskatoon City Hospital
- Some pathologist have gained flexibility in their daily scheduling (those that used to work at Paul's hospital full-time)
- Easier sharing of cases and access to consultation with colleagues
- Easier access to histologic and immunohistochemistry lab
- Easier access to residents if they are at City Hospital
- Subspecialization
    - Improved quality of service
    - Improved turnaround time for some specimens
    - Improved teaching
    - Better report consistency
- Reduction in number and cost of external consults leading to financial savings
- Exceptionally immunohistochemistry service (selection of stains and turnaround time)
- Exceptionally immunofluorescence quality
- Advanced diagnostic research lab access
- Improved pathologists' office equipment (availability of stand-up desks in many offices)

Neuropathology
Dr. Roland N. Auer, Dr. Viktor A. Zherebitskiy

Brief History:

With a catchment area of the province of Saskatchewan, neuropathology has been historically served by a sole neuropathologist from the early 1950's to late 1980's comprising Drs. Jerzy Olszewski and Bohdan Rozdilsky. After that, between 1990's and 2014 the solo neuropathologist service was augmented by temporary overlap with invited for locum second neuropathologist or anatomical pathologist who performed neuropathologist duties on part time basis. Following neuropathologists were practicing in this period of time: Drs. Lee Cyn Ang, David Munoz, Lothar Resch, Rob Macaulay, Chris Robinson, Christopher Dunham, Ali G. Saad and Mark Hiken. The augmentation was inconsistent and accompanied by some logistic problems. Responding to that, the departmental leadership (Drs. J. Blondeau and F. Magee) requested an external review in 2014. The review was done by a senior neuropathologist from Manitoba, Dr. Marc Del Bigio. Based on workload analysis, Dr. Del Bigio recommended to get at least 2 FTEs for provincial neuropathology service. Drs. J. Blondeau and F. Magee were successful in securing funding and hiring two neuropathologists (Drs. Roland Auer and Viktor Zherebitskiy) for Saskatoon in time when the neuropathology service due to various reasons dissolved. The period of time between 2015 and 2019 1.3-1.5 FTE for Saskatoon and 0.5 FTE for Regina formula was successfully implemented. The Regina neuropathology service was designed to share intraoperative diagnostics and initial workup between 3 general anatomical pathologists (Drs. Ted Alport, Angus Kirby and Jill Wooff) with further consultations sent to Saskatoon. This system is still in place until now. In early 2019, Drs. Magee and Kinloch managed to secure another 0.5 FTE for Saskatoon neuropathology and 2.5 FTE neuropathology model was introduced in June 2019. Since that time it has successfully functioned providing full neuropathology service for ~1.1 million population. During the last 4 years under supervision of Dr. Magee, the neuropathology section was able to reinstate consistent neuropathology coverage of surgical and hospital autopsy cases. Also, a unified provincial system of molecular genetic testing referral based on collaboration with KDL/OHSU and some other leading institutions was successfully implemented. With increase of FTEs dedicated to neuropathology, the neuropathology section was able to support extended teaching of medical students, residents and fellows. Also, this was beneficial for increase in research activities and collaboration with basic medical researchers and clinicians province wide. This has definitely elevated the neuropathology profile.

Present Status and Activities:

Biopsy service:

- Full scope of diagnostic neuropathology practice including neoplastic and non-neoplastic brain biopsies or resections and also nerve and muscle biopsies (comprise the majority of specimens).
- Through dedicated rounds and tumor boards interactions with neurosurgeons and radiation and medical oncologists (mainly on CNS and PNS neoplasia) and other clinicians including neurologists, rheumatologists, diagnostic radiologists, internists, pediatricians, infection control, palliative care and podiatrists (mainly

non-neoplastic CNS and PSN conditions with systemic involvement (e.g. amyloidosis, sarcoidosis, CNS/PNS infection)

Autopsy service:

- Brain cutting and brain-only autopsies for urgent, routine and on-demand hospital autopsy cases driven by physicians and families
- Brain cutting and brain-only autopsies for world class Parkinson's and Motor Control Clinic run by Drs. Rajput's (Sr. and Jr.)
- Occasional consultations on brain pathology for Coroner's Office

Ocular pathology service:

- Biopsies, partial resections, eviscerations, enucleations and exenterations of eyes and orbit contents (mainly Dr. Zherebitskiy)
- Consultations for child abuse cases (mainly Dr. Auer)

Communication with clinicians through preparation and participation in following rounds and tumor boards:

- Clinical Neuroscience Rounds (weekly)
- (Adult) Neuro-Oncology Rounds (weekly)
- Pediatric Oncology Rounds (weekly)
- Pathology & Laboratory Medicine Grand Rounds (monthly)
- Epilepsy Rounds (monthly)
- Ophthalmology Grand Rounds (biannually)
- Internal Medicine Grand Rounds (ad hoc)
- Pediatrics Grand Rounds (ad hoc)

Teaching:

- **Undergraduate student teaching**
  - Supervision of Vedashree Meher, MSc projected APR 2020, stroke emboli (Dr. Auer)
- **Graduate student teaching**
  - MS3 and MS students who requested either general pathology or dedicated neuropathology elective
- **Postgraduate (residents and fellows)**
  - General pathology resident rotations
  - Neurosurgery resident rotations
  - Neurology resident rotations
  - Other residents including diagnostic radiology, internal medicine, rheumatology (more on an ad hoc basis)
- **Type of activities:**
  - Formal Teaching (e.g. slide sessions for GP residents on Thursday 0800-0900, lectures for GP residents on Academic Half-Day Fridays, lectures for neurology or rheumatology residents on their AHD's, etc.
  - One-on-one teaching
  - Participation in OSCE exams (e.g. neurology residents)

Research:

- **Self-Initiated (local)**

- Subdural hematoma, retinal hemorrhage and non-perfused brain in resuscitated and unresuscitated interstitial pneumonia in infancy and toddlers (Dr. Auer)
- Short fall calculator (Drs. Auer & Zherebitskiy)

- **Basic Medical Research Driven (local):**
  - Dr. Anand Krishnan (Dept. Anatomy, Physiology & Pharmacology, CoM U of S) – "Nerve tumor interface" (Dr. Zherebitskiy et al)
  - Dr. Changiz Taghibiglou (Dept. Anatomy, Physiology and Pharmacology) "Indip, a Novel SREBP1 Inhibiting Peptide, for the Treatment of Glioblastoma Mutiforme" (Dr. Zherebitskiy *et al*)
  - Dr. Frank Cayabyab (Neuroscience Cluster, COM, U of S) "Receptor signaling in neurologic diseases including CNS tumors (Drs. Auer & Zherebitskiy)
- **Clinical Medicine Research Driven (local):**
  - Drs. Ali and Alex Rajput (Dept. Neurology, COM, U of S) "Movement Disorders Studies" (including brain banking) - Drs. Auer & Zherebitskiy
  - Drs. Jose Tellez-Zenteno & Adam Wu (Dpts. Neurology and Neuro-surgery, COM, U of S) "Epilepsy Disorders Studies" (including brain banking) - Drs. Auer & Zherebitskiy
  - Dr. Luke Hnenny (Dept. Neurosurgery, COM, U of S) "Methylation profiling of meningiomas as a clinical predictor of the need for escalation or de-escalation of clinical follow-up and redo surgeries" -Drs. Auer & Zherebitskiy
  - Vijayananda Kundapur (Radiation Oncology, Cancer Centre) "Treatment effect of microbeam radiation in naturally occurring tumors in dogs" - Drs. Auer & Zherebitskiy
  - Dr. Paul Banin *et al* "Post-mortem Brain MRI for IPD patients (Dpt. Diagnostic Radiology, COM, U of S)
- **New Research Initiatives (local):**
  - Saskatchewan Cancer Research Institute (founding members)
  - Saskatchewan Brain Tumor Research Group (founding members)
- **National & International Collaboration:**
  - SickKids, UTH, BCCA,U of C (Canada - Toronto, Vancouver, Calgary)
  - OHSU, UCSF, NIH/NCI, University of Miami (USA – Portland, San Francisco, Bethesda, Miami)

Publications: (with medical students, residents and other faculty)

1. Rajput AH, Rajput EF, Bocking SM, **Auer RN**, Rajput A (2019) Reply to: Parkinsonism in essential tremor cases: A clinicopathological study-were they really essential tremor? *Mov Disord.* **34**(11):1750. https://doi.org/10.1002/mds.27868 PMID: 31743513

2. Olivier CJ, Li H, **Auer RN**, Dixit D (2019) Disseminated alveolar echinococcosis in a 74-year-old woman presenting with focal seizure. *CMAJ.* **191**(34):E940-E943. https://doi.org/10.1503/cmaj.181258 PMID: 31451525

3. Rajput AH, Rajput EF, Bocking SM, **Auer RN**, Rajput A (2019) Parkinsonism in essential tremor cases: A clinicopathological study *Mov Disord.* **34**:1031-1040 https://doi.org/10.1002/mds.27729 PMID: 31180613

4. Johnson D, (2018) Response to Jenny *et al*. https://doi.org/10.1089/neu.2016.4687 Biomechanical Response of the Infant Head to Shaking: An Experimental Investigation. *J Neurotrauma.* **35**:1045-1048 https://doi.org/10.1089/neu.2017.5420 PMID: 29233066

5. Adams SJ, Kirk A, **Auer RN** (2018) Adult-onset leukoencephalopathy with axonal spheroids and pigmented glia (ALSP): Integrating the literature on hereditary diffuse leukoencephalopathy with spheroids (HDLS) and pigmentary orthochromatic leukodystrophy (POLD). *J Clin Neurosci.* **48**:42-49

6. https://doi.org/10.1016/j.jocn.2017.10.060 PMID: 29122458

7. Berlow NE, Svalina MN, Quist MJ, Settelmeyer TP, Zherebitskiy V, Kogiso M, Qi L, Du Y, Hawkins CE, Hulleman E, Li XN, Gultekin SH, Keller C. (2018) IL-13 receptors as possible therapeutic targets in diffuse intrinsic pontine glioma. PLoS One. **13**(4):e0193565. https://doi.org/10.1371/journal.pone.0193565 PMID: 29621254

8. **Auer RN**, Laganière JL, Robitaille YO, Richardson J, Dion PA, Rouleau GA, Shekarabi M. (2016) KCC3 axonopathy: neuropathological features in the central and peripheral nervous system. *Mod Pathol.* **29**:962-976 https://doi.org/10.1038/modpathol.2016.90 PMID: 27230413

9. Cao M, Cortes M, Moore CS, Leong SY, Durosier LD, Burns P, Fecteau G, Desrochers A, **Auer RN**, Barreiro LB, Antel JP, Frasch MG (2015) Fetal microglial phenotype in vitro carries memory of prior in vivo exposure to inflammation *Front Cell Neurosci.* Aug 4;9:294. https://doi.org/10.3389/fncel.2015.00294 PMID: 26300730

10. Garman RH, Li AA, Kaufmann W, Auer RN, Bolon B. (2016) Recommended Methods for Brain Processing and Quantitative Analysis in Rodent Developmental Neurotoxicity Studies. *Toxicol Pathol.* **44**(1):14-42 https://doi.org/10.1177/0192623315596858 PMID: 26296631

11. Bissel SJ, Auer RN, Chiang CH, Kofler J, Murdoch GH, Nix WA, Painter M, Richer M, Sartelet H, Wang G, Wiley CA. (2015) Human Parechovirus 3 Meningitis and Fatal Leukoencephalopathy. *J Neuropathol Exp Neurol.* **74**:767-777 https://doi.org/10.1097/NEN.0000000000000215 PMID: 26115191

12. Chance A, Liu JJ, Raskin JS, Zherebitskiy V, Gultekin SH, Raslan AM. (2015) Thoracic primary central nervous system melanoma and lumbar schwannoma of complex neurocristopathy: case report. *J Neurosurg Spine.* **23**:780-783 https://doi.org/10.3171/2015.3.SPINE141265 PMID: 26296191

Administration:

- Medical School Admission Committee, CoM, U of S (Dr. Zherebitskiy)
- Nomination Committee, CoM, U of S (Dr. Zherebitskiy)
- Saskatchewan Assocation of Laboratory Medicine (Drs. Auer & Zherebitskiy)
- Pathology & Laboratory Medicine Grand Rounds Committee (Dr. Zherebitskiy)

Future Directions:

- hosting national meeting – Canadian Association of Neuropathologists annual meeting, October, 2020
- Repatriation of CNS tumor testing (in collaboration with Drs. J. Decoteau and W. Xi – ADRL & SHA/RUH Molecular Genetic Centre respectively)
- Establishing methylation profiling of CNS tumors locally (in collaboration with Dr. D. Anderson, NGS laboratory, COM, U of S)
- Establishing local brain tumor bank (in collaboration with Dpts. Neurology, neurosurgery and BMR)
- Upgrade of provincial molecular genetic testing of CNS tumors according with AANP/CAP-2020 guidelines (in collaboration with Cancer Care/neurosurgery – Saskatoon/Regina)
- Evaluating potential with provincial brain donation program for neurodegenerations outside movement disorders (in collaboration with Dpt. Neurology)
- NP manpower & workload analysis in Regina (potential for extra ½ FTE for neuropathologist in Regina).
- Neurosurgeons/neurologists/rheumatologists-muscle biopsy)

Limited Surgical Pathology Provincial Review
Dr. Ted Alport, Interim Area Lead, Regina
Wednesday, March 4, 2020

Introduction

Clinical expectations of the Surgical Pathology Service have changed dramatically over the last decade. Public concern about diagnostic error, expanding knowledge base and challenges in recruitment (particularly in Rural Saskatchewan) are just a few of the factors placing increasing demands on the service. This review focuses on problems with the current service delivery model and makes a number of recommendations intended to create a safer, more cost effective service.

2.0 Current Status

2.1 Recruitment

Recruitment of qualified Surgical Pathologists with specialty expertise is becoming increasingly difficult. Both Regina and Saskatoon have several vacancies and despite national and international ads, we are attracting few applicants. A national shortage, very significant greying in both departments, increasing complexity (Molecular Diagnostics), and increasing workload (estimate 5%-10% per year) all contribute. The goal of attracting well-qualified candidates is now trending towards only being able to recruit those with marginal qualifications.

The situation in Rural Saskatchewan is even more dire. Historically, Saskatchewan has hired General Pathologists to smaller sites who primarily practice surgical pathology (including autopsies) but also help manage the clinical laboratory. From the former six sites, we are now down to three – Moose Jaw, North Battleford, and Prince Albert. With recent information (confidential at this time) that Dr. Skihar will be looking at other practice opportunities upon completion of his contract in October, all three sites have vacancies with only North Battleford having one half-time candidate who has not yet been successful in challenging the Canadian Exams. Two of three remaining pathologists are senior and eligible for retirement. All three incumbents are very uncomfortable practicing alone and even more concerned about the prospect of working with inexperienced and underqualified candidates.

For new graduates, these positions are inherently unattractive – in addition to isolation, they do not have easy access to colleagues to share and show cases and obtain formal second opinions. Incumbents are also expected to perform gross pathology, hospital autopsies and have some responsibility to oversee the Clinical Laboratory. The latter effectively excludes Surgical Pathology candidates who generally have no training in Hematology, Blood Bank, Chemistry or Microbiology. Candidates familiar with national trends will be concerned about job security knowing that small isolated practices are being phased out across the Country. Qualified candidates now expect to work in larger groups with subspecialist colleagues in an environment with continuous learning.

Recruitment of Pathology Assistants is equally challenging (see below).

2.2 Quality

Over the last decade, a flurry of high profile National and Provincial reviews have brought the issue of diagnostic accuracy in Surgical Pathology to public attention. A common theme in all reports was the risk of small group practice. Significant changes have been made in most provinces.

The above scenario is a textbook example of the type of practice cautioned against in all the above reviews. Structurally, these are still independent practices with the Pathologist serving as a solo Department Head who reports to the chief of staff who rarely is in a position to monitor and ensure safe practice. All sites have significant issues relate to workload volume, coverage, lack of access to subspecialists, second opinions and special studies (ex – Immunohistochemistry).

Several pathologists have raised significant quality concerns about diagnostic error. Pathologists see this as a system risk and feel they too would be at risk if left to practice alone without the internal auditing that occurs through daily prospective and retrospective review in a group practice. The possibility of critical events leading to a very expensive retrospect review of an entire practice (seen before in this province) is small but this is the very type of practice prone to such events. Diagnostic criteria and nuanced details expected by oncologists change regularly and an environment with subspecialists and continuous learning, afforded by a group practice is essential to keep current and ensure safe surgical practice.

2.3 Cost and Efficiency

Maintaining full technical support (staff equipment) for five surgical pathologists is very inefficient (see below).

In Summary, the current practice model is unsafe, inefficient and not sustainable. The current surgical pathology practice is too complex, evolving too quickly, and too expensive to support a model that the National Inquiries have all cautioned against. Simply, there is no natural solution that will maintain the current practice model.

3.0 Recommendations

The more positive news is that there are straight forward steps that can be taken to improve patient safety, lower cost and should be well accepted by all parties.

Some strategic principles that should be agreed upon – a pretty elementary list but worth restating:

1. Independent small group (Surgical Pathology) practice should be strongly discouraged and integrated into the larger group practices in Regina and Saskatoon (service delivery can still be local).
2. The trend towards subspecialized surgical pathology practice in Regina and Saskatoon should be encouraged and work standardized.
3. Recruitment should focus on fully qualified graduates with subspecialist training or experience.
4. The Forensic Pathology Service should be a full specialty service centralized in Regina and Saskatoon (already done).
5. A quality agenda should be advanced to ensure that standards of care are met with respect to complex specimens being handled by those with special expertise, obtaining second opinions on all high risk cases, accreditation standards are met, and strong ties are built with the Cancer Agency (ex. Tumor boards) and other Agencies such as Canadian Partnership Against Cancer (CPAC).
6. Education programs should be leveraged with IT support (telepathology, webinars) and made available province wide.
7. The LIS should be rationalized – eventually moving to one AP system. Pathologists should have easy access to clinical information and all previous pathology results.
8. The focus of the Royal College Residency Training Programs should be aligned with the training and skills required by the SHA Laboratory Service.
9. With the exception of the low volume or complex work, all work should be insourced and performed in Saskatchewan.

Firstly, a comment on “when and how”. Change in any organization depends on competing priorities, resources and necessity. Given the challenge of recruitment to smaller sites and safety issues, it is now absolutely “necessary” to make this a priority item.

It needs to be emphasized that these recommendations requires no additional funding, will reduce cost and result in safer practice.

The recommendations are as follows:

3.1. Medical

3.1.1 Structure and Medical Staff Model

SHA should quickly transition to two Surgical Pathology services. This does not mean centralization or re-location of services but it needs to be clear this is a Provincial service managed out of two sites. At the medical level this is easily achieved by formally credentialing (medical staff membership and privileges) the four “rural” pathologists in either Regina or Saskatoon. They should also continue to be associate members of medical staff in their respective sites and continue to practice locally. This model is not new and is precisely the arrangement we have with the Regina Forensic Pathologist - Dr. Nistor is a member of Saskatoon Medical staff so the Chief Forensic Pathologist in Saskatoon can oversee the quality of her work and performance. Dr. Nistor is also an associate member of the medical staff in Regina and works almost exclusively in Regina. This simple step makes these physicians members of the Regina and Saskatoon Section of Surgical Pathology with the Section Heads becoming responsible for overseeing the quality of work, professional assessment, scheduling work, call etc.

For Southern Saskatchewan, every effort should be made to have Dr. Skihar stay in Saskatchewan – he is now fully qualified and is also training in Neuropathology- a subspecialty he enjoys and would like to use. This is clearly an unused asset in Moose Jaw while, at the same time, Regina has five or six Neurosurgeons and no Neuropathologist. The natural solution is for Dr. Skihar to relocate to Regina. Dr. Skihar is also hopeful to work in a larger community. Dr. Etches would be given the option of relocating to Regina or to continue working in Moose Jaw (with tailored workload, CME, coverage and oversite from Regina). This is very doable – it is worth recalling that for a two-year period, all surgical pathology from the FHHR (both processing and interpretation) was performed in Regina. This was done on short notice with all arrangements being made in a few days. This was safer for patients (subspecialty group practice reporting cases) and well accepted by the local physicians.

At a personal level, this arrangement would be much better for Dr. Skihar – improved professional opportunity using his Neuropathology training, more professional interaction with better access to second opinions and an environment with continuous learning and CME. He would no longer have to participate in the gross pathology and he would also be working in a larger community (something he is looking for). Dr. Etches would benefit as well – more tailored workload, better access to second opinions, better CME. Again, no gross pathology.

For Northern Saskatchewan, the considerations are similar. While some progress has been made, these are still independent practices, with ongoing recruitment issues, poor coordination of workload and challenges with quality assurance. This should be one integrated service with single medical staff (local service delivery can still be maintained). Rather than recruitment to small group practise, recruitment should be tailored to the needs of the northern service.

3.1.2 Autopsy Service

The remaining hospital autopsies in Moose Jaw are few in number and done by pathologists who may not have interest or expertise in the autopsy service. Recruitment, training and maintenance of competence also become very difficult for the pathology assistants who do very few cases. It is recommended these cases be done in Regina

using SHA facilities used by the Coroners Department (same arrangement as Cypress, Sunrise and Sun Country). Savings should result from more efficient staffing, maintenance (capital and operations) and repurposing the unused laboratory space.
Similar considerations would apply for Northern Saskatchewan.

3.2 Administration and Infrastructure

3.2.1 Administrative Structure

The Administration Infrastructure should reflect two services with the Regina and Saskatoon Anatomic Pathology managers given responsible for the two services. Working in a dyad with the Medical Leads, they would be responsible for planning and managing the Northern and Southern services (potential administrative savings).

3.2.2 LIS

The Provincial goal of one LIS for the Province does not need to take five years for Surgical Pathology. Because of different versions and different program builds, aligning the Regina and Saskatoon service will take some work but the LIS in the three smaller sites should simply be discontinued. With two services, there should only be two LIS's. For the South, the primary location of the AP service is at the Pasqua Hospital with "itinerant" service at RGH (quick sections and two pathologist work stations). The service simply needs to add Moose Jaw as a similar site. This would not change hardware or staffing and would result in significant cost savings (no need to spend time on licensing, maintenance, version upgrades, and standardizing the existing LIS's in smaller sites). This should not be difficult as we have the precedent of the Regina Pathologists being "licensed" in Saskatoon LIS Service and remotely dictating and reporting Saskatoon cases from Regina. Radiologists all report remotely (home, Alberta etc).

Perhaps more importantly, the Pathologists in smaller sites would have access to previous pathology. It is quite unfathomable to practicing Pathologists how others can practice without quickly being able to look up previous pathology results. Looking up cases in SCM or eHealth is prohibitively slow and only used for difficult cases.

Current contracts with SCC should be reviewed but this would clearly result in a better, safer patient care and reduced cost.

Even without a common service, the LIS's should be rationalized. Resources and time could then be focused on integrating the Regina and Saskatoon LIS services

3.2.3 Staffing

Processing surgical specimens is a labour intensive complex work that is critical to achieving safe reporting of surgical specimens. Misinterpretation of the clinical information or the gross pathological findings can easily lead to inaccurate diagnosis and prognostic information – this in turn can lead to inappropriate surgery, chemotherapy and radiation therapy. The range in complexity is broad (radical cystic prostatectomy to gastric biopsies) and the challenge is to have properly trained individuals handle the more complex specimens.

The role of pathology assistants is now the effective standard of care for processing surgical specimens. These individuals are extremely well trained and far less expensive than having surgical pathologists perform this work. On-the-job trained individuals cannot achieve this level of training. Under appropriate direction, staff with lesser qualifications can certainly handle simple specimens. The current service delivery model with pathologist performing gross pathology in the smaller site is antiquated, costly and a barrier to recruitment. Recent graduates do not expect to do this work.
Regina has been fortunate in recruiting two unlicensed pathologists and two pathology assistants to handle complex specimens, write procedures, train and oversee the work of others in the department. Saskatoon has been less fortunate and has had to contract with an out of province Pathology Assistant to provide this service. It needs to be emphasized these are key positions and without additional staff (currently precarious in both Regina and Saskatoon), there will be repeat of the bottleneck in specimen processing that invited the attention of the Provincial Auditor. Limited capacity in Saskatoon and Regina will also limit the ability to centralize processing (see below). The working relationship with Calgary Lab Services to participate in their training program is an excellent step but more needs to be done to stabilize the staffing in this area.
At best, it is likely that only Regina and Saskatoon will be able to recruit these individuals.

3.2.4 Capital Equipment

Automation with high volume processors, automated stainers, cover slippers and immunohistochemical equipment has replaced manual procedures in all but very small laboratories. Similar to the rest of the laboratory – automation is more cost effective and less prone to human error. Both specimens and slides are easily transported so it is now easy to process centrally, with slides transported and interpreted at any site. This means there can be a local pathology presence in smaller communities to handle quick sections and communicate more directly with medical staff.

In summary, for our small population of one million, maintaining five processing sites is unnecessary. Central processing will result in better quality, is safer and more cost effective. This need not be done immediately (or completely - ? three sites) but should be phased in when opportunities present themselves – staffing shortages, retirements or equipment needs replacement.

3.3 Quality Assurance

A quality agenda should be pursued. This is a very simple list but includes:

a) The above recommendations are key elements of a quality agenda
b) Maintaining accreditations standards (much easier with two services)
c) Ensure standards of care are met in areas such as synoptic reporting, obtaining mandatory second opinions on all high risk cases and developing common metrics for clinicopathological correlation and occurrence reporting

4.0 Summary

This review is very limited in scope and does not address other complex issues such as enhanced molecular diagnostics, education, integration of the larger LIS's and appropriateness. Rather, the focus is on the current service delivery model which I believe

is unsafe, too expensive and unsustainable. This report focuses on some simple steps that can be taken immediately to improve service. Properly done, these should not require any additional resources and should be well accepted by all parties.

The advantages are summarized as follows:

a) Improve patient safety
b) Avoid of system risk (complies with National recommendations)
c) Better service delivery and coverage
d) Easier to meet accreditation standards
e) Better alignment of work volumes with specialty expertise, pathologist training and experience
f) Better environment to provide subspecialty care and provide second opinions
g) Better ability to recruit
h) Better environment for continuous learning
i) Simpler, safer and more cost effective LIS infrastructure
j) Reduced costs – medical and support staff, capital equipment and LIS infrastructure

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Regina
Dr. Ted Alport
Area Department Lead, Regina
(Leading a team of approximately twenty-eight members.)

I would first like to highlight the contributions of Dr. Bahera Mali and Dr. Jeff Eichhorst who both will be retiring in the next few months. Dr. Mali has been the Medical Chemist at the Regina General Hospital for 30 years and Dr. Eichhorst at RRPL for 40 years. You may not see them on the wards but there is not a patient or physician who doesn't rely on their work each and every day. Under their watchful eye, collectively they have overseen 15,000 Newborn screenings, 80,000 Drug Screenings and 10,000 Serum Protein Electrophoresis cases every year, as well as 10's of Millions of other Chemistry testing during their career!! We wish them all the very best in a well-earned retirement.

2019-2020 saw further integration of RQHR and RRPL Laboratories – we now have one unified medical staff with common Department Leads and Division Heads. The administrative management structure has also been aligned.

Much of the work on the department has been on setting up Provincial Discipline Specific Working Groups (Surgical Pathology, Hematopathology, Microbiology, Chemistry, Genetics, Water Laboratory). The primary focus of these groups has been to perform the difficult task of standardizing and some cases rationalizing test menus and platforms across the province. Another challenge and common theme in many of the areas has been difficulty recruiting to fill positions and increasing demand for clinical service. Notwithstanding these challenges, a lot of good achievements.

Some of the major goals and contributions for the last year include:

Goal 1: Connected care for the people of Saskatchewan: improve team-based care in communities and reduce reliance on acute care services.

- Genetic Resource Centre – added DNA banking for Regina Area from microarray send outs – this now permits full provincial coverage of reflex molecular genetic testing
- Working towards expansion of newborn screening
- Provide rapid on-site evaluation (ROSE) of deep-seated biopsies in pulmonary and gastrointestinal endoscopic procedures to ensure adequate samples of diagnosis and prognostic testing, i.e. EGFR, ALK-1, PDL-1 for lung carcinoma. This reduces unsatisfactory rates and unnecessary repeat procedures
- Department members are engaged in a Quality Improvement Initiative with Neonatology on optimizing and reducing total collections and tests ordered
- Participation in national study on female specific reference intervals for myocardial infarction – Regina selected as one of the first sites to go live

Goal 2: Create a health system culture that promotes patient and staff safety.

- Successfully met compliance requirements of the new ISO accreditation standard for the Water Quality Section at the Roy Romanow Provincial Lab following an on-site inspection
- Implementation of a specimen tracking system to minimise specimen handling errors is underway in Saskatoon and is being planned in Regina

Goal 3: Establish physicians as leaders in the health-care system.

- Genetic Resource Centre and Molecular Genetics at RRPL work in close collaboration with Dr. Kellie Davis and her team of genetics councillors

Goal 4: Improve system wide coordination and alignment of services.

- Improved testing accuracy and consolidated dialysis water analysis for the southern region of the province at the Roy Romanow Provincial Lab
- Co-ordination of ancillary testing of specimens (e.g. molecular pathology) with Saskatoon to streamline testing and utilise in-province expertise
- Completed the RFP process for high volume chemistry testing at Regina laboratories; Pasqua, RGH and RRPL
- Continued development of Genetic Resource Centre's role to improve collaboration with the Medical Genetics Clinic, Roy Romanow Provincial Laboratory, Royal University Hospital and Advance Diagnostic Laboratory Genetic Testing Services

Highlight of the year was repatriation of the Provincial Prenatal Testing Program (maternal serum screening for alloantibodies and administration of RHIG to prevent hemolytic disease to the newborn). Previously performed by Canadian Blood Services in Vancouver, this testing is now performed in Prince Albert, Regina and Saskatoon.

Provincial Microbiology Discipline Specific Group
Dr. Joseph Blondeau, Brandi Keller
10 MAR 2020

Current Microbiology Laboratory Services:

Microbiology services in Saskatchewan are currently offered in both Saskatoon (Royal University Hospital) and Regina (Regina General Hospital). In addition, the Roy Romanow

Provincial Laboratory (RRPL) in Regina provides specialized Microbiology diagnostic testing for the province.

There are 6 rural sites in the providing Microbiology testing. Three in the North (North Battleford, Tisdale, and Prince Albert) and three in the South (Weyburn, Moose Jaw and Yorkton).

Testing not performed at a rural laboratory is referred on to an urban laboratory. The location of referral is dependent on current transportation routes.

Provincial Microbiology Discipline Committee:

The Provincial Microbiology Discipline Committee held its first meeting on March 22 2019 with subsequent quarterly (in person) meetings held (June 6th 2019, October 29th 2019, and January 16th 2020).

Monthly one-hour webex meetings to discuss targeted projects have been initiated in February 2020.

Standing agenda items include a Public Health Report, Biosafety Report and an in depth review of all Critical Incidents related to the Microbiology Discipline.

The committee is co-chaired by a clinical and administrative director dyad. This dyad relationship has proven to be a successful model in the leadership of the team. Membership includes Microbiologists (Regina, Saskatoon and RRPL), regulatory affairs representation, and rural/urban operational managers.

Technical expertise from both urban and rural are pulled in on projects as needed.

Highlights of Improvements:

- A historical concern in the rural sites has been the lack of Microbiology clinical support.

A key objective of the committee included site visits by the Microbiologists to each of the 6 rural laboratories. As of October 2019, all 6 rural laboratories have been visited by a Microbiologist, with continued visits planned.

“On call” requests from Northern based physicians and laboratory technologists have increased in the past several months and were undoubtedly influenced by these visits.

Supporting Documentation:
Agenda Microbiology Site Visit North Battleford February 8, 2019

- Influenza testing was historically performed only at RRPL and the Royal University Hospital. With the implementation of Influenza testing in 8 rural sites and Regina General Hospital, the turnaround time of testing has reduced drastically and there has been improved care to the patients of Saskatchewan.

Supporting Documentation:
Distributed Influenza Testing Presentation

- Established and elevated the important role of Public Health and worked collaboratively to establish a virtual program, such that all clinical staff in the province are taking a leadership role in in key areas of expertise.

- Sub-specialty working groups developed within clinical Microbiology, each with an identified subject expert and clinical lead or co-lead.

- Through collaboration with the Infection Prevention and Control (IPAC) team and laboratory, Extended Spectrum Beta Lacatamase (ESBL) screening has been discontinued and Carbapenemase Producing Organisms (CPO) screening is now performed in Saskatoon and Regina.

- Standardization of one provincial Microbiology requisition is in progress.

- Request for Proposals (RFP) in progress to ensure standardization of equipment and processes.

- Implementation of *"position statements"* as a means of communication to all Microbiology laboratories and stakeholders in order to provide a concise process to communicate changes and updates the committee has made.

Supporting Documentation:
Strategic Plan (OKR) Microbiology 2019-2020

Perceived obstacles (Gaps):

Transportation

The turnaround time of laboratory testing is critical to patient care and safety in rural and remote facilities. Due to transportation constraints, there are occasions when testing does not meet the expected timelines of the clinicians or may be rejected due to extended transport time.

Human Resources

Human Resources continue to be an ongoing challenge in both the clinical and technical areas.

Aging equipment and New Technology

New and emerging technologies are continually on the market. Laboratory equipment is costly and the laboratories have had to rely heavily on local foundations to support equipment purchases.

Communication on Changes Made Provincially

As the committee provides direction on changes to best practice and implements standardization, communication to all stakeholders is key to the success of the program.

Laboratory Information System (LIS)

A key objective of the Microbiology group is standardization.

The LIS is currently on 12 different instances that are currently not connected. In order to provide standardized reporting comments across the province, this lack of connectivity provides an additional challenge to standardization.

Future Plans to Address Gaps:

In order to ensure clinicians receive high quality, timely results that meet the needs of the patients in Saskatchewan, numerous improvements to address gaps are in progress:

- Transportation routes. A provincial approach to transportation challenges is in progress.
- Consideration of current state and future state test menus in all Microbiology laboratories. Repatriating testing/decentralizing testing as appropriate.
- Clinical and Technical Resource Planning and recruitment is in progress.
- Capital equipment replacement. Coordinated planning and identification of risk on aging equipment and technology with consideration of where future testing will occur.
- Communication on changes made provincially. Identification of all stakeholders needed when changes and improvements are implemented.
- A business case has been submitted to the ministry to implement a single Laboratory Information System (LIS) instance.
- Continued site visits by clinical staff to identify gaps with rural sites.

With the inception of the Microbiology Discipline Committee, numerous improvements have been coordinated and implemented. The collaboration and communication within the Microbiology team has positively impacted the services across the province. Improvements to patient care and services will continue as the committee continually identifies and prioritizes future objectives and goals.

Transfusion Medicine
Dr. Sheila Rutledge Harding
06 MAR 2020

d) *Briefly outline the clinical services and programs offered by the department and identify whether they are local, regional or provincial in scope*.

- Consultation and support throughout Northern Saskatchewan – years ahead of implementation of SHA, through the SK blood office (called SaskBlood), a collaborative provincial team of TM physicians, managers and front-line technologists
- Stem cell processing for provincial stem cell program
- Lead (provincial reference) site for recently implemented *Prevention of Alloimmunzation in Mothers of Saskatchewan (PRAMS) Program*, repatriating all provincial prenatal transfusion testing from Canadian Blood Services in Vancouver to Regina, Prince Albert, and Saskatoon

e) *Describe any challenges and issues negatively impacting the department's ability to provide expected clinical services, according to the following areas*:

i. Physician resource planning

Differences in historical delivery models between Regina (hematopathologists) and Saskatoon (clinical hematologists) hamper our ability to fully integrate our services, especially regarding on-call, etc.

ii. Physician recruitment and retention
iii. Maintenance of and support for diversity in the physician work force
iv. Generalist, specialist and subspecialist clinical service gaps
v. Clinical service gaps related to access and wait times
vi. Clinical service gaps related to inadequate or absent facilities or equipment
vii. Specialist-generalist-primary care communication and collaboration gaps

We have the benefit of defined funding for TM consultants, north and south. We are acutely aware that there are many rural sites that lack effective local oversight by laboratory clinicians, which would facilitate better local liaison regarding transfusion practice with our colleagues who practice in those rural environments. Our on-call models allow us to provide advice in individual circumstances, but we do struggle to get a "foot in" to local practice culture, etc. For example, despite using SHA email, SHA bulletins, SMA bulletins, CPSS newsletters, etc., we have encountered many rural physicians who have nevertheless been surprised by the recent changes to prenatal testing, the need for a new requisition, etc.

viii. Clinical services planning, organization, coordination and funding
ix. Physician clinical payment structures

Our single biggest impediment to operating efficiently in Saskatoon is the lack of assigned administrative support. We've being trying to recruit for over a year now and are being stymied by the "temporary" designation of the posting – viable candidates have consistently chosen another offer of permanent employment over the position we have to offer.

f) *Describe how the department is addressing gaps, issues and challenges as outlined in the previous question*.

The TM Division Head in the Saskatoon area is also the (interim) Provincial Clinical Lead for Transfusion Medicine. The Provincial TM Discipline Committee began meeting in mid-2019 and is working toward addressing clinical service gaps, safety and quality issues, lack of standardized practice, etc.

g) *Describe specific mechanisms the department employs to ensure that clinical services are high-quality and that quality improvement remains paramount*.

TM Physicians meet with senior laboratory staff three times/week to review on-call cases, questions, Safety Reports, etc., and to fine-tune policies and processes as needed to ensure quality and safety.

Any serious errors, particularly those that might put patient safety at risk, are reviewed and addressed immediately. In addition, a Transfusion Error Surveillance System (TESS) is use by TML staff to record any and all errors that come to attention. This log is analyzed quarterly by the TM Division Head and then reviewed by the TM Operations Committee to identify common or recurring errors so that they can be addressed systematically.

An area inter-professional Transfusion Committee of stakeholders (physicians, nurses, technologists, safety managers, Canadian Blood Services representative, etc.) meets quarterly to address issues of quality and safety. TM Physicians also attend Transfusion Committee meetings (by videoconference) in other former health regions, to provide input and advice.

h) *Describe quality improvement work department members have undertaken that led to changes in the way clinical care is provided locally and/or nationally*.

Dr. Oksana Prokopchuk-Gauk is the current Chair of the National Advisory Committee (NAC) on Blood and Blood Products, and has co-authored some of their recommendation documents

Dr. Sheila Rutledge Harding chaired the Interprovincial Medical Expert Committee in 2017-2018 that developed and published *Criteria for the clinical use of immune globulin* for implementation in Alberta, Manitoba and Saskatchewan. Order sets for appropriate administration of IVIG have also been developed and implemented

Participation in the Canadian START (Screening by Technologists and Auditing to Reduce Transfusions) Study significantly improved appropriateness of red blood cell transfusions and the use of single-unit transfusions in Saskatoon and Regina.

Provincial recommendations for best practice in various aspects of Transfusion Medicine, pediatric and adult, have been developed and disseminated.

i) *Describe specific mechanisms related to maintaining and improving patient safety*.

In addition to initiatives described in e), we implemented the *ABO Confirm* process to enhance the safety of type-specific transfusion, which has now been adopted province-wide.

Our Transfusion Safety Officer performs regular audits, often with the participation of interested resident physicians, to inform the ongoing education provided by the Division to nursing units and physician groups.

j) *Describe specific mechanisms that ensure clinical services are responsive to patient needs*.

We have included a patient representative in our PRAMS planning.

k) *Describe any clinical programs or initiatives designed specifically to address the needs of socially marginalized or vulnerable patient populations*.

The next phase in implementation of the PRAMS program, in collaboration with colleagues who provide obstetrical care, will be the hiring of three nurse coordinators to ensure that all pregnant patients, regardless of location or circumstance, are able to access due care and attention to prevent (if possible) and manage alloimmunization in pregnancy.

l) *Identify how department strengths will assist in addressing any trends, opportunities, or challenges that lie ahead with respect to the provision of expected clinical care*.

Participation/leadership on regional and national bodies helps TM to take advantage of opportunities (i.e., established relationships with colleagues in TM elsewhere led to our participation in START and also helped to prepare us for PRAMS) and to anticipate and prepare for challenges (i.e., involvement in NAC).

HEMATOPATHOLOGY
Dr. Emina Emilia Torlakovic, MD, PhD, Division Head
08 MAR 2020

1. Update since last departmental review:

a) *When was the last review*?
- This report from the Hematopathology Section pertains since my arrival to Saskatoon, in August 2017.

f) *Briefly outline any new or emerging factors/trends/issues that will likely have a direct impact on the department in the next 5 years*.
- The most important factors/trends/issues that will likely have a direct impact on Hematopathology in the next 5 years are the provincial integration initiative, increased number of pediatric patients with higher complexity pathology as a result of the recently opened pediatric hospital and development of molecular classification of diseases in hematopathology.

2. Strategic planning:

a) *Does the department have a strategic plan*?
- Yes. As yet there is no specific strategic plan for Hematopathology but all Discipline Specific Groups have been tasked with developing such a plan for their areas of practice.

1. Patient care mandate:

a) *Briefly outline the clinical services and programs offered by the department and identify whether they are local, regional or provincial in scope*.

- Hematopathology in Saskatoon provides the following services for both adult and pediatric populations regionally (see below); however, as the provincial initiative develops, the discipline specific group will play an increasingly provincial role.
    - bone marrow biopsy evaluation/reporting, lymph node(s)
    - other tissue sites evaluation for hematological lesions (e.g. lymphoma, leukemia, etc.),
    - bone marrow aspirate cytological assessment,
    - peripheral blood testing from CBC to cytological assessment,
    - body fluids differential counts, crystal identification, cytological assessment
    - identification and speciation of malaria and other blood parasites
    - hemoglobinopathy assays
    - flow cytometry of the following samples: peripheral blood, various fluids (CSF, pleural fluid, etc.), tissue samples (e.g. lymph node, spleen, etc.)
    - comprehensive menu for coagulation testing
    - assay development and quality assurance for all of the above (local, regional, and provincial)
    - assistance and guidance for validation of analyzers and methods locally, regionally, and provincially
    - clinical resource/consultative service for clinical staff provincially
    - on-call services for all of the above

b) *Describe any challenges and issues negatively impacting the department's ability to provide expected clinical services, according to the following areas*:

i. Physician resource planning – Our pediatric population is increasing and along with that the level of complexity is increasing because patients that have or would otherwise be potentially referred out of province are now our patients. Having children's hospital is not just building rooms with beds for children, but providing also specialty care that goes along with that. Both the number of pediatric patients and the complexity of services that they need has been increasing since I joined the Department in 2017.

ii. Physician recruitment and retention - When I joined the Department in 2017, hematopathology division was understaffed functioning with only about 50% of required staff physicians. Dr. Fergall Magee was instrumental in our recruitment efforts and we were able to successfully recruit new hematopathologists for total of about additional 1.7 FTE. Dr. Magee was also a key person for ensuring that external review of hematopathology happens and that the most qualified reviewer(s) were considered/invited for this purpose.

iii. Maintenance of and support for diversity in the physician work force – Although Division of Hematopathology is smaller than most other divisions of Pathology and Laboratory Medicine, it reflects diversity at its best with almost any staff physician being from different country, religion background, and with women representing majority of staff.

iv. Generalist, specialist and subspecialist clinical service gaps – In hematopathology, subspecialty services are highly heterogeneous and the training paths that lead to certification in hematopathology may differ significantly. Basically, some specialist come from clinical hematology background and some from general pathology background. This has a major impact on the subspecialty expertise that they may have. Physicians coming from clinical hematology background usually have very high expertise in non-neoplastic

hematopathology (e.g. transfusion medicine and coagulation), while physicians who come from pathology background usually have very high expertise in neoplastic hematology (e.g. leukemias, lymphoma). We try to recruit individuals in a balanced manner, but that is always a challenge. Additionally, at the moment, we do not have any pediatric hematopathologists and are all participating in providing this service. Optimally, at least one of the hematopathology staff would have subspecialty expertise in pediatric hematopathology to support the rest of the staff. In order to build this expertise, we need to send at least one of our hematopathologists for additional education as an observer to a large children's hospital which has reputation and sufficient expertise to educate our staff. Funding for the 3 months observership at the BC Children's Hospital would be ideal because of their large size and excellent reputation in pediatric hematopathology. This funding would require budgeting for the travel and stay in Vancouver as well as locum person to cover services in SK during the absence of one of our hematopathologists. Dr. Magee is very supportive of this, but providing funding for this has not yet been secured.

v. Clinical service gaps related to access and wait times – Dr. Magee has made major strides to improve access to professional support in hematopathology for rural sites as well as coverage across the province. However, we are still not sufficiently staffed to provide these services provincially to all sites that need such access/support at the moment. Wait times (essentially turn-around-time (TAT) for pathology reports of all different types in hematopathology has been if not improved at least kept as it were with new recruitments). However, not all depends on the professional staff; wait times are currently impacted by insufficient support staff (administrative support and technologists) and our current LIS that cannot be fully adopted to new landscape of laboratory medicine. One special area is that of ADRL, laboratory that performs most molecular testing for our oncology patients. Hematopathology is critically dependent on molecular studies and not having ADRL being an official part of our Department is a huge mistake. This are is also evolving to become an indispensable clinical tool for all types of malignancies as well as non-malignant diseases and we are indebted to Dr. John Decoteau that managed to establish this laboratory and provide these critical services to our patients despite all problems related to the laboratory definition or standing. However, the solution needs to be found for this laboratory to be assimilated to SHA, specifically to our Department. This is strategically essential for patient care, quality assurance, patient safety, patient outcomes, quality improvement, and also definitely for research mandate of our department. I cannot see any other viable solution to this problem and if we fail to do this now, there will be hugely negative impact to both, patient care and research mandates. Appropriate funding should be secured for these services without question.

4. Teaching mandate:

a) *Briefly describe the department's teaching contributions in UGME*.

- Hematopathology staff in Saskatoon do not participate in UGME to the my best of my knowledge.

b) Briefly describe the department's teaching contributions in PGME.

- GP residents rotate through hematopathology. Dr. Magee supported multiple changes that I wanted to introduce in hematopathology rotation, both in the scheduling of residents as well as in the content of the subject. We have made these changes and now our residents finish this rotation being able to independently formulate and report hematopathology cases including bone marrow reports, peripheral blood morphology/cytology reports, flow cytometry, hemoglobinopathy, etc. This is a major

achievement since none of this was possible for residents before these changes were introduced.

g) *Briefly describe the department's graduate education contributions*.

- Graduate education is provided by Dr. John DeCoteau (Advanced Diagnostic and Research Laboratory).

h) *Briefly describe the department's contributions to CPD both within and outside the department*.

a. I am often invited as a speaker/lecturer for national and international events. This is detailed in my CV. The Department was always strongly supportive of these initiatives.

b. In addition of being an invited speaker/lecturer, I have also developed a national proficiency testing program for pathologists' readout for predictive and prognostic biomarkers in oncology (precision medicine), which has obtained support from the Canadian Association of Pathologists as also is certified for Section 3 credits from RCPSC. Please see www.cbqareadout.ca. CBQAReadout.ca is currently developing many new modules for teaching as well as for proficiency testing. This includes, but it is not limited to modules for breast cancer biomarkers, MMR biomarkers, malaria identification and speciation, red cell morphology, standardization of H-score, etc. These programs will be available to both pathologists and laboratory professionals (technologists and technicians) as teaching/educational tools as well as competency/proficiency assessments. Dr. Magee was instrumental in providing his support and encouragement for this project. This program is now internationally promoted by the International Network for Pathology (IQN Path, please see www.iqnpath.org) where this program is recommended and is given entire page for promotion. Although it was launched only in last November, this program is now used for certification in pathologists' readout in many different countries rising quickly to already achieve global reach and impact.

c. I have also moved Canadian Immunohistochemistry Quality Control (CIQC, which I have co-founded about 10 years ago), specifically its branch that provides proficiency testing for immunohistochemistry-based predictive/prognostic biomarkers and biomarkers of high complexity to the U of S; this also with a support of Dr. Magee. This branch is now called Canadian Biomarker Quality Assurance (CBQA), was started on January 1, 2020, and is at the moment conducting its first run for PD-L1 testing in lung cancer as well as its first run for ROS1 testing in lung cancer. As an academic program, we also innovate modalities of proficiency testing and this component is always published in peer-reviewed literature. The CBQA is also organizing national educational events in the form of Symposia and Academic Forums where leading Canadian and international experts are invited to present. CBQA is also starting the first Canadian national proficiency testing for molecular diagnostics with a focus on prognostic biomarkers in oncology. The first PT run of this type is in development to be executed this coming summer. We are bridging between traditional PT and PT that rises to higher standards dictated by precision medicine. One example of immediate international recognition of CBQA is that I just got a confirmation that the internationally renowned expert from Harvard (Brigham And Women's Hospital, Harvard Medical School) will volunteer as an expert assessor for our first ROS1 PT run joining our Canadian experts in this field.

d. The presence of CIQC (now CBQA and CBQAReadout.ca) in our Department, enabled us to quickly repatriate several predictive biomarkers and provide high level of quality of biomarker testing for patients in whole SK. Additionally, we have become one of a few Canadian reference center for new PD-L1 assay in triple negative breast cancer. From here, we also issue reports certifying validation of several new biomarkers for laboratories across Canada including BCCA, Toronto labs, Alberta labs, etc.
e. Our Department is also being invited to lead IHC protocol development for emerging biomarkers for entire Canada (e.g. ROS1 in 2018/2019 for CROS study, and now NTRK assay for CANTRK study), which is funded by pharmacological industry.

i) *Briefly describe any other teaching contributions, including interdisciplinary teaching*.

a. Our hematopathology division also hosts observers and residents from other departments/specialties.
b. Dr. Magee facilitated and strongly supported the development of Biomarker Development and Quality Assurance departmental committee, which I co-chair with Dr. Kinloch. This committee helps coordinate planned and timely development of new biomarkers (molecular and other), oversees quality and management of current predictive biomarkers, harmonizes practices across the Province, and also provides education to oncologists regarding modalities of testing and test performance characteristics, which is essential for their clinical applications.

5. Research mandate:

d) *Provide examples of original departmental research, analysis or other scholarly activity that have resulted in innovations or advances in clinical care*.

- I think the development of CBQAReadout.ca and CBQA-PCAB both could be mentioned here as these two are both innovations in proficiency testing for predictive biomarkers for oncology and are directly relevant to clinical care.
- I have led the development and publishing of Canadian national guidelines for PD-L1 testing (published in AIMM last year). The abbreviated version of these guidelines will be published in two other journals in near future.
- Meta-analysis of interchangeability of PD-L1 IHC assays has been published by Modern Pathology; this paper brought about much clarity in this field. It is changing how regulatory agencies around the world are now considering approvals for various purposes for these CDX assays. I was the first and the corresponding author.

g) *Briefly describe how the department provides mentorship for new researchers. AND*
i) *Briefly describe how the department supports research undertaken by residents*.

c. Although Division of Hematopathology did not recruit new researchers since my arrival to this Department in 2017, I am strongly encouraged by Dr. Magee to include residents and newly recruited staff in research projects of all different types. One approach to deal with constant shortage of staff for administrative and educational activities as well as for research was to encourage structuring our daily activities and quality assurance initiatives in such way so that they may become publishable with learning messages to be applicable beyond our local environment. Our division has engaged residents and new staff in contributing to

assessment of inter observer agreement for various clinical assays (e.g. CD34 IHC assay for blasts in bone marrow biopsy), encouraging residents to publish case reports, and other. This approach has also stimulated active evidence-based approach to all our practices increasing overall patient safety.

j) *Are departmental policies and procedures sufficient in number and scope, clear, transparent and regularly communicated*?

a. The Division of Hematopathology (Saskatoon) has an ongoing evaluation of SOPs to ensure that they are updated and reflect current practices. At any given time, some SOPs are being revised.

k) *Is exceptional performance, whether clinical or academic, recognized, acknowledged or rewarded*?

- I think my performance has been exceptional, but not sure if I got any recognition or rewards for it. I am not sure that we have any specific process for this and if we did, what would be considered exceptional here.

l) *Are departmental lines of communication open and effective, including those involving the Provincial Head*?

- Yes, but open and effective communication also requires adequate administrative support, which we are lacking.

m) *Describe the overall culture of the workplace, as identifiably associated with the department*.

- As I have worked in this Department from 2004 – 2010 and now again from 2017, I can state that the overall culture of the workplace of our Department has drastically improved. From a place where mobbing, backstabbing, cheating, unfairness, lack of accountability, and friendship-based approach to promotion and other benefits was commonplace topped with looser-attitude that we should not be even trying because we are the worst in Canada, our current culture is that of respect, fairness, collaboration, properly measured accountability, optimism, and culture of support to each other, high ethical values, and patient-centered care. I see this at every level including our top leadership, our management, our doctors, and our technologists. When problems arise (of any type, technical or otherwise), the whole team is involved in helping and trying to improve whatever the issue may be at hand. I am very happy to work here and would not change my workplace for any other.

n) *Does the department have a conflict resolution mechanism in place and is it effective*?

- It does, but in our hematopathology division, we did not have any conflicts so far so I am not 100% sure what specifically is available.

o) *Is workplace and job satisfaction for departmental staff monitored and are any issues/challenges effectively addressed*?

- In our Division, I am not the only one who is monitoring all the time our staff job satisfaction and am working with the team and on all fronts to increase job satisfaction even if no objective parameters could be changed. We know that we are continuously supported in this by our leadership.

p) *Is workplace safety actively monitored and are any issues immediately addressed*?

- This is one of the routine items that is actively continuously monitored and immediately addressed.

r) *Is the current Provincial Head viewed as a good communicator, inspiring leader and strong relationship builder*?

- Absolutely. In my opinion, Dr. Fergall Magee was the main source of inspiration and overall improvement of work culture in our Department. I honestly do not think that any of the positive changes would happen without him.

s) *To the extent applicable, does the Provincial Head allocate workload or assign duties, whether clinical or academic, in a fair and transparent manner*?

- Absolutely.

t) *Does the Provincial Head appear to fulfill his/her mandate with respect to the position description and reporting/accountability expectations*?

- I am not sure about the scope of the question, but as known to me, the answer is unequivocal yes.

u) *Does the Provincial Head keep department members up-to-date regarding health system and college changes, developments, initiatives and expectations*?

- Yes.

v) *Does the Provincial Head effectively manage communication and relationships with key stakeholders and constituents such as faculty, learners, staff, administrators, other departments, allied health professionals, government representatives and health institutions*?

- Yes.

w) *Is the Provincial Head a capable and trusted manager of departmental resources? Are allocation decisions collaboratively discussed? Do they remain consistent with the department's strategic priorities? Are available resources sufficient for fulfilling the departmental mandate*?

- Absolutely.

Provincial Genomics Discipline Specific Group
Dr. Fergall Magee, Clinical Lead

Background

Genes and genome

Genetic material within human cells is stored in the chemical DNA. The information content of the DNA molecule is expressed in the sequence of proteins (base-pairs) along its length; this sequence acts as a code that specifies the production of different proteins responsible for carrying out the functions of the cell. Within the cells long DNA molecules are packaged within chromosomes which reside within the nucleus; each chromosome contains a particular set of genes arranged in a specific order. The term 'Genome' refers to the total genetic content of an individual. If the genome can be likened to an encyclopedia, an individual chromosome can be viewed as a single chapter and a base-pair as single letter.

‘Molecular Diagnostics’ refers to the utilization of biological methods to elucidate the genetic and molecular basis of many diseases. The processes involve the extraction of DNA from cells to determine the base-pair sequence. Significant advances have occurred in this area over the past decade allowing for more sophisticated DNA testing. It is now possible to detect more subtle abnormalities, to test more samples (patients) per ‘run’ and perform many more ‘interrogations’ per individual sample, and to achieve all of the above in a significantly shorter ‘run time’. This diagnostic technique/platform is referred to as Next Generation Sequencing (NGS) and is based on rapid and multiple analyses of extracted DNA.

The term- ‘Genomics’-refers to this ability to measure the expression of large numbers of genes at the same time, by means of a single process.

Genomics is revolutionizing diagnostic and therapeutic practice. The application of this technology is spreading through an increasing number of health care fields.

1. Prenatal diagnosis

    a. Non-invasive pre-natal testing (NIPT) comprises the NGS analysis of a maternal blood sample to detect free fetal DNA and probe it for specific mutations/abnormalities.

    b. Current practice requires a hospital admission for mother and a surgical intervention (amniocentesis). Up to 70% of amniocenteses could be replaced by NIPT.

2. Newborn screening

    a. Current standard of practice in the area of newborn screening is based on analysis of fetal blood samples for biochemical abnormalities-this practice is now being augmented and replaced by NGS analysis to detect specific mutations/abnormalities in fetal DNA.

3. Metabolic disease of neonates

    a. Current diagnostic practice utilizes cytogenetic examination, micro-array analysis and biochemical metabolic studies. This is being replaced by more effective NGS analysis.

4. Organ Transplantation

    a. Compatibility of organs for transplantation is confirmed by characterization of human leucocyte antigens (HLA). Unambiguous genotyping is technically challenging due to a high degree of variability of the corresponding genomic region. Next generation sequencing is now the ‘standard of practice’ as it allows for faster sampling of more specimens per run- and delivers are more accurate analysis, with improved patient outcomes.

5. Specific disease therapies

    a. Tumor/companion diagnostics

i. Companion diagnostics refers to the practice of determining optimal anti-cancer therapy on the basis of NGS profile of tumor.

b. Epilepsy therapy

i. BC and Ontario have introduced NGS testing of children and parents as a necessary step to determine optimal therapy for children who present with epilepsy.

c. Autism Spectrum disorder

i. Groups in Ontario (Scherer et al) are about to recommend NGS analysis of patient with Autism Spectrum Disorder (ASD) to determine optimal therapy.

d. Schizophrenia

i. A proposal similar to that for ASD is being developed for Schizophrenia and Cerebral Palsy.

6. Infectious disease (Microbiology)

a. NGS testing in the area of microbiological diagnostics will more fully integrate pathogen surveillance into the treatment of infectious disease and enhance antimicrobial resistance/susceptibility testing.

7. Pharmacogenomics

a. NGS sequencing may be useful in both the identification of drug targets (pharmacogenomics) and patient genetic markers of drug efficacy or toxicity (pharmagenetics). The FDA has is giving serious consideration of recommendations for NGS testing for a panel of specific mutations prior to any therapeutic drug administration.

8. Population Health Genomics

a. The NHS is currently investigation the potential of funding population testing in an initial trial of 100,000 individuals in an attempt to help planning of future health services. The intent is to improve patient outcomes through the development of enhanced assessment with simplified triage systems to facilitate seamless access to genomic medicine.

Current State in Saskatchewan

There are four laboratories in the province that offer human genetic testing services. Two of these - including the only Cytogenetics laboratory in the province - are located in RUH, a third is located in the Health Sciences complex at the adjacent University of Saskatchewan while the fourth is a newly established human genetic testing facility situated in Regina within the Roy Romanow Provincial Laboratory (RRPL). Genomic testing for tissue transplantation is being implemented in SPH (Dr. Marc Baltzan Histocompatibility (HLA) Laboratory) while genomic testing of microbes occurs in RRPL and the Molecular Microbiology Laboratory in RUH.

1. The Cytogenetics lab at the Royal University Hospital in Saskatoon is the only lab in the province that offers on-site cytogenetic testing services. This lab offers routine G-banding karyotype examination-based on older technology-on blood and bone marrow samples, prenatal amniocentesis samples (with the exception of CVS); and also provides limited but increasing access to molecular testing platforms.

2. The Human Molecular Genetics lab (HMG) at the RUH was established in September 2012, and functions in association with the Cytogenetics lab. Heading this lab, and Director of both the Cytogenetics/HMG facility is a recently hired an ABMG-certified molecular geneticist. The HMG lab currently has recently relocated from the 2nd Floor of RUH (G Wing) to join the main cytogenetics laboratory on the 5th floor of G wing. This lab currently provides a limited selection of molecular tests but with the recent addition of a ABMG-certified Molecular Geneticist and Division Head, the RUH molecular lab has recently implemented Rapid Aneuploidy Diagnosis (RAD)-[FEB 2019] and is about to validate a newly acquired MiSeq (NGS platform).

3. The Advanced Diagnostic Research lab (ADRL), located in the RUH-affiliated University of Saskatchewan Medical College campus, houses a clinical lab within a research environment. Led by a Medical Director, this lab provides acquired diagnostic genetic testing for solid tumour, lymphoma, and malignant hematology samples (Companion Diagnostics), as well as testing for residual disease.

4. Molecular Microbiology (2nd and 3 floor RUH) utilizes PCR technology for the identification of microbial pathogens. Currently work in the laboratory is dominated by the response to the COVID-19 pandemic as they perform up to 450 tests for COVID-19 per day.

5. The Dr. Marc Baltzan Histocompatibility (HLA) Laboratory is currently validating a next generation sequencing platform to optimize matching of recipient to donor organs. There is also an imitative to acquire NanoString technology (application has been submitted to the SPH Foundation) to allow for earlier diagnosis of organ rejection.

6. The Roy Romanow Provincial Lab (RRPL) located in Regina joined the SHA from the Ministry of Health in 2018. Formerly the Saskatchewan Disease Control Laboratory, the RRPL move to the SHA was a recommendation of the Saskatchewan Advisory Panel. There is a CCMG certified Molecular Geneticist on site. RRPL began offering molecular testing for some disease predisposition gene panels in-house, using NGS in early 2018. Indicatives are currently underway to expand NGS testing at this site to include non-invasive prenatal testing (aneuploidy) and hemoglobinopatheis. The Genetics Resource Centre (GRC) is a collaborative union between Medical Genetics and the RRPL Molecular lab. It was established and became operational in November 2018, after recognition for the need to track clinical services, test requests, and results. The role of the GRC is to centralize and track referred-out genetic testing for the province, provide a mechanism to ensure appropriateness of genetic testing, and determine the need for expanding local genetic testing services based on the patterns of referred out testing. The GRC employs a genetic counsellor (located in Saskatoon) who reviews all molecular genetic test requests, with samples centralized and sent out through the RRPL Molecular lab in Regina.

The greater portion of COVID-19 tests (up to 1500 tests per day) also occurs at this location.

Obstacles

The human genomics laboratories provide access to genetic testing for the entire province. Clinical services dependent on this type of testing include Medical Genetics, Maternal-Fetal Medicine, Pediatrics and pediatric subspecialties (Neonatology, Metabolic disease, Immunology, Neurology and Hematology Oncology among others), Cardiology, Oncology, Nephrology and Transplantation Medicine (and in a time of Pandemic-Public Health and Acute Care). Testing demands from all of the above users are increasing and will continue to do so.

Two main obstacles exist to the development of a genomics service appropriate for the needs of the population of Saskatchewan-the absence of **secure funding** and lack of Ministry of Health **engagement** in discussions around a timely implementation of this technology.

Funding for genetic services varies among the constituent laboratories. The laboratories located in RUH (Cytogenetics and Human Molecular Genetics) and St. Paul's (Baltzan HLA laboratory) have budgets managed through SHA Laboratory Medicine. The human genomic laboratory at RRPL is also funded by the SHA. All of these budgets are inadequate for the demands of each laboratory and do not allow for timely implementation of new technology and testing panels (e.g. non-Invasive Prenatal Screening (NIPS), expanded newborn screening (Severe Combined Immune Deficiency), diagnostic panels for neonatal metabolic acidosis (exome sequencing), screening for hearing impairment, treatment selection of pediatric epilepsy etc).

Funding for ADRL is an on-going and greater challenge as this laboratory does not have a budget to support the clinical work that is requested of it. The introduction of clinical testing performed in this laboratory is evaluated and approved by the **Biomarker Development and Quality Assurance Committee**. This group of experts comprise members from the Saskatchewan Cancer Agency (SCA), Anatomic Pathology, Hematopathology, Pharmacy, Genomics and Laboratory Operations. Potential new testing is evaluated by means of a decision matrix which been developed by the Committee (please refer to Appendix 3 for an example of this decision matrix). Costs for tests requested by authorized physicians are billed to the SCA, but funding from operating grants and research are required to bridge the financial gap incurred by on-going, new clinical test development and validation. While ADRL has been very successful in repatriating a large number of cancer tests and continues to expand its test menu, the current financial model is not conducive to sustainability or growth.

Please see additional comments on Genomics from Dr. John DeCoteau (ADRL), Dr. Ahmed Mostafa (HLA) and Nick Antonishyn (RRPL). See also Briefing Note - ADRL (21 JAN 2020) in Appendix 3.

Advanced Diagnostics Research Laboratory (ADRL)
Dr. John DeCoteau
23 MAR 2020

m) *Briefly outline the clinical services and programs offered by the department and identify whether they are local, regional or provincial in scope*.

The Advanced Diagnostics Research Laboratory (ADRL) was created in 2012 within the University of Saskatchewan, College of Medicine to develop, validate, and perform state-of-the-art diagnostic and monitoring tests for Saskatchewan cancer patients using new technology platforms such as 10-color flow cytometry, digital PCR, and next generation sequencing (NGS). The ADRL holds a lab license issued by the Saskatchewan Ministry of Health and is accredited by the Western Canada Diagnostic Accreditation Alliance (WCDAA). The ADRL Medical Director is a Division Head within the unified Department of Pathology and Laboratory Medicine in Saskatoon.

Since its inception, the lab has developed and validated key high complexity cancer tests to ensure that standard of care testing is made available to Saskatchewan Cancer Agency (SCA) clinicians managing a variety of solid tumors and hematologic malignancies. The ADRL also continues to leverage its expertise in companion diagnostics and high sensitivity monitoring to implement minimally invasive and liquid biopsy approaches that are destined to become standard of care tests in the near future.

Two key accomplishments of the ADRL in support of patient care include:

- **Improved Cancer Diagnostics with Reduced Reliance on Referral Testing**

The test menu offered by the ADRL is now comparable to those at all major oncology centers in Canada. Maintaining an updated cancer test menu at the ADRL, that is aligned with the needs of modern oncology practices, will continue to reduce Saskatchewan's reliance on outside institutions to provide cancer diagnostic and monitoring tests.

- **Increased Test Volumes to Meet Provincial Demands**

The ADRL has been very successful in repatriating a large number of cancer tests previously referred out of the Province. The lab also has a proven track record of keeping pace with cancer discovery, and rapidly responding to the clinical demands for developing, validating, and implementing new companion diagnostics. The number of tests that will be performed and reported by the ADRL in 2020 is projected to exceed 3,000. Prior to the ADRL becoming operational, all of these tests were either referred outside of the Province or not performed at all, to the detriment of optimal cancer care.

b) *Describe any challenges and issues negatively impacting the ability of the ADRL to provide expected clinical services, according to the following areas*.

i. Physician resource planning, recruitment, and retention
Although the ADRL has only been fully operational for a few years, the ongoing increase in test demands will soon require hiring additional professional staff members to contribute to new test development and provide service coverage.

A major challenge facing the growth of molecular pathology is the low level of exposure to the discipline (and pathology in general) currently afforded to undergraduate medical students. It is unclear how this problem will be addressed, as the undergraduate medical curriculum was only recently restructured.

ii. Clinical service gaps related to inadequate or absent facilities or equipment

There is an acute needfor the ADRL to acquire more space, as the lab is at capacity, and will need to increase its complement of technical staff by 2.0 FTE within the next year, and a further 2.0 FTE within two years, in order to meet increasing test demands. So far, petitions by the department to acquire additional space for the ADRL within the College of Medicine have not been successful.

In the past, the ADRL was equipped using funds provided by the SCA and Choc'laCure, a local charity. These pathways for acquiring new capital equipment are no longer available. In order to keep pace with immediate service demands, the lab has resorted to leasing several pieces of equipment by accessing fee-for-service funds that are needed for operations. This ad hoc capital equipment funding mechanism is not sustainable, and the lab will soon face a major challenge, as there are a number of essential capital equipment pieces that will be required within the next 1-2 years. The lab is not aware of a defined mechanism offered by the department to acquire new capital equipment or obtain funding for their service contracts.

iii. Clinical services planning, organization, coordination and funding

Clinical services planning by the ADRL is guided by a November 2018 external review of provincial genomics services. This report recommended that "the ADRL should maintain and continue to develop expertise in genetic testing of acquired/somatic variants" and that the "lab should continue to work with oncologists in the SCA in planning for future growth and development in molecular cancer testing". The ADRL enjoys strong partnerships with SCA oncologists and hematologists in working to prioritize new test development in the areas of companion diagnostics and risk stratification. The lab also works closely with the Saskatchewan Health Authority (SHA) Anatomic Pathology and Hematopathology Divisions to develop and implement standard of care diagnostics. Accordingly, the ADRL has assumed leadership roles in repatriating referred oncology diagnostics and in developing new cancer tests for the province. These activities are endorsed by the Provincial Genomics Working Group.

A major challenge for ADRL relates to funding, as currently there is only compensation for clinical work provided to the SCA, and the lab must rely on grants for continued development and validation of new tests. The external review stated that "there needs to be a provincial funding structure for the ADRL" and recommended the creation of a unified provincial strategic plan for genetic laboratory services, including a shared provincial funding strategy for test repatriation, anticipated service expansion, and capital equipment acquisitions. However, the department has adopted the position that because the ADRL is outside of the SHA structure, it should be considered an external lab, akin to an out of province vendor such as Calgary Lab Services. This poses a threat to the sustainability of the ADRL, by negatively impacting on its abilities to plan for future growth and development in the area of molecular cancer testing for

Saskatchewan, and to secure capital equipment needed to fulfill the ongoing test requirements of oncologist and pathologist end users.

iv. Physician clinical payment structures

College of Medicine pathologists within the department have been informed that the University considers the top tier of the provincial pathologist salary grid to be a ceiling, not a floor. This has resulted in a clawing back of merit increase salary awards from those academically productive College of Medicine pathologists who have reached the top tier of the provincial salary grid. This practice has been going on for years, and have led academically productive pathologists to question the point of this incentive program. As it currently stands, this merit-based system has had the effect of eroding, not bolstering, morale among this group of pathologists. The problem has been exacerbated by their awareness that academically unproductive faculty members, at the top tier of the provincial salary grid, recently received large monetary packages from the University for transferring to the SHA, and that some pathologists working outside of the University system earn above the top tier.

c) *Describe how the department is addressing gaps, issues, and challenges for the ADRL as outlined in the previous question*.

Presently, it is unclear how additional professional manpower resources will be acquired. However, based on past experiences recruiting faculty members into the Division of Experimental Pathology, there may be opportunities through the College of Medicine budget planning and priorities process. The close integration between research and clinical activities at the ADRL provides opportunities for academic physicians and clinical scientists to pursue careers in molecular pathology at the University of Saskatchewan. There is also the potential to create positions through the SHA to expand molecular pathology service coverage by recruiting molecular pathologists and/or by providing molecular cancer diagnostics training to interested pathologists from other specialties such as anatomic pathology or hematopathology.

The presence of the ADRL within the College of Medicine provides excellent training opportunities for pathology residents to gain expertise in modern molecular pathology diagnostic procedures. By offering structured rotations through the ADRL, the University of Saskatchewan is now one of only a few pathology training programs in Canada that provides pathology residents with hands on training experiences in high complexity diagnostics. The ADRL Medical Director was recently appointed to a Royal College of Physicians committee to develop guidelines for creating molecular pathology training programs in Canada. The need for subspecialty training in molecular pathology is considered to be a high priority, as it is well recognized nationally that high complexity diagnostics will assume an increasingly important role in patient diagnosis and treatment. Training opportunities offered at the ADRL will also help to fulfill Saskatchewan's future needs for highly qualified personnel, such as MLTs with training in molecular pathology, and bioinformatics specialists.

d) Describe the specific mechanisms the department employs to ensure that ADRL clinical services are high-quality and that quality improvement remains paramount.

The department provided an avenue for the ADRL to become a partner in the SHA Provincial Genomics Working Group, which is committed to the “philosophy of patient-

centeredness and culture of quality improvement". The department also provided an opportunity for the ADRL to participate in quality improvement initiatives through the creation of a Cancer Biomarker Committee that comprises members from the SHA, University of Saskatchewan, and the SCA.

e) *Describe quality improvement work the ADRL has undertaken that led to changes in the way clinical care is provided locally and/or nationally*.

The ADRL has collaborated with the Division of Anatomic Pathology in Saskatoon to repatriate EGFR mutation testing for advanced lung cancer patients from an out of province laboratory. Use of ADRL next generation sequencing methods, and streamlining of pre-analytical and post-analytical processes, have decreased test waiting times from 6 weeks to under 10 days, and the need for repeat testing due to test failure from 35% to less than 2%. As patients with advanced lung cancer positive for EGFR mutations require urgent therapy with specific targeted inhibitors, the decreases in test wait times and repeats offer significant advantages to them. These quality improvement measures have been adopted throughout Saskatchewan with testing centralized in Saskatoon. This research is being prepared for publication, which may have the potential to influence clinical practice nationally.

f) *Describe specific mechanisms related to maintaining and improving patient safety*.

The ADRL is actively developing non-invasive 'liquid biopsy' monitoring methods for patients with lung cancer. This is expected to dramatically reduce the need for invasive biopsy procedures in lung cancer patients that progress while receiving targeted therapies.

In collaboration with SCA hematologists, the ADRL has developed and implemented a risk stratification algorithm for newly diagnosed AML patients using next generation sequencing. This approach has identified several low risk patients that were treated with chemotherapy rather than allogeneic stem cell transplantation. Prior to performing genetic profiling for risk stratification, these patients would have received allogeneic transplantations, unnecessarily exposing them to toxicity. Similar risk stratification models are being adopted for clinical use to assist with the management of endometrial cancer patients. The ADRL, in collaboration with Dr. Mary Kinloch, Head of the Division of Anatomic Pathology in Saskatoon, is leading efforts nationally to implement clinical diagnostic tests to identify endometrial cancer patients with POLE mutations. As POLE mutated endometrial cancers do not require intensive postoperative radiotherapy or chemotherapy, identifying these patients spares them from the potential complications of radiotherapy and chemotherapy.

A pilot project is now underway to discriminate individual patient samples in next generation sequencing tests by including sex-linked and polymorphic genetic markers in cancer panels. This will reduce or eliminate inaccurate results and patient harm that can result from sample mislabelling.

g) Describe specific mechanisms that ensure clinical services are responsive to patient needs.

The ADRL contributes to excellence in cancer care by providing clinicians with access to a high complexity diagnostics service that is responsive to their needs, and capable of rapidly implementing new tests in an evolving practice environment. ADRL membership on committees that embrace the philosophy of patient-centeredness (e.g. Cancer Biomarkers Committee; Provincial Genomics Working Group; Multidisciplinary Lung Cancer Group) ensures that test development is done in collaboration with clinical oncology and pathology partners, in accordance with national or international practice guidelines. Feedback offered to ADRL from clinicians on these committees helps to inform test development priorities to account for patient needs.

The ADRL has several research projects funded by the Saskatchewan Centre for Patient Oriented Research (SCPOR) that aim to evaluate if specific clinical cancer diagnostics are responsive to patient needs. One recent example includes a project that surveys patient attitudes to a novel molecular diagnostic test, called Proactive Molecular Risk Evaluation (ProMisE), that is capable of accurately and reproducibly risk stratifying endometrial cancer patients. Besides providing clinicians with essential information to assist them in managing endometrial cancer, the research also focuses on how ProMisE is explained to patients and how patients use the information. This project resulted in the creation of an interdisciplinary Research Advisory Committee (RAC) that includes patient partners, care providers, researchers, allied health team members, and health care decision-makers. The RAC is co-chaired by Mary Kinloch (Anatomic Pathology), Laura Hopkins (Surgical Oncology), and Deb Clark (Patient Partner) and is responsible for directing and coordinating research activities related to endometrial cancer care that are destined to be implemented clinically.

h) *Describe any clinical programs or initiatives designed specifically to address the needs of socially marginalized or vulnerable patient populations*.

The specialized nature of ADRL clinical services has not permitted the development of specific initiatives to address the needs of socially marginalized and vulnerable patient populations. However, the repatriation of BCR-ABL monitoring by the ADRL, that was previously sent to the BC Cancer Agency, has greatly improved convenience for those patients with chronic myeloid leukemia living in rural and remote areas of Saskatchewan. Prior to the ADRL repatriating this test, patients from rural and remote areas were required to stay overnight in Saskatoon in order to have their blood drawn early in the morning on the day of their test to meet out of province shipping timelines. Performing BCR-ABL monitoring locally now permits out of town patients to have their blood drawn later in the day and avoid an overnight stay in Saskatoon.

i) Identify how department strengths will assist in addressing any trends, opportunities, or challenges that lie ahead with respect to the provision of expected clinical care.

A major department strength that assists the delivery of ADRL clinical services is the close collaboration between the lab and the Divisions of Anatomic Pathology and Hematopathology. The heads of these divisions have advocated for the repatriation of current molecular cancer testing that is out-sourced to other provinces or countries, and for support to expand ADRL services to meet increasing demands for cancer diagnostics. Streamlining of tissue processing, and anatomic pathology assessment of neoplastic content prior to NGS analysis, are key components of the quality improvement measures that have greatly improved turnaround times related to solid

tumor companion diagnostics and monitoring. Collaborations between Mary Kinloch (Anatomic Pathology Division Head) and the ADRL on patient-oriented research projects continue to build capacity in the area of advanced molecular diagnostics to support the optimal care of Saskatchewan patients with gynecological cancers. This program has gained profile nationally and led to multidisciplinary collaborations between Saskatoon based pathologists, oncologists, surgeons, and medical geneticists. A major research initiative to implement molecular minimal residual disease (MRD) monitoring to improve the management of AML and ALL patients is underway in collaboration with Mark Bosch (SCA Hematologist) and Emina Torlakovich (Hematopathology Division Head).

Dr. Marc Baltzan Histocompatibility (HLA) Laboratory
Dr. Ahmed Mostafa
07 MAY 2020

Clinical Services: The HLA Lab located in St. Paul's Hospital in Saskatoon is the only provincial laboratory accredited by the American Society of Histocompatibility and Immunogenetics (ASHI) and it provides service to the whole province. HLA lab provides a 24/7 service for both solid organs and bone marrow transplantations. In addition, the lab provides disease association studies and pharmacogenomics through a vast number of tests to other clinicians that aid in disease screening and treatment. In 2019, the HLA lab performed over 6000 HLA typing tests, 6000 single antigen bead test, and 90 flow cells cross match. 45 patients received solid organs transplant from either a deceased or a living donor. In addition, 30 bone marrow recipients received transplantation from either related or unrelated donors through national and international bone marrow registries.

Challenges that had been addressed: In attempt to improve the level of resolution of the HLA typing, the National Marrow Donor Program announced that by February 2021 HLA typing will only be accepted if it was performed by sequencing based methods. Since the HLA Laboratory doesn't have a sequencer, this means our HLA typing will not be accepted nationally and can result in discontinuation of the service. The department addressed the issue in a timely manner and we are currently in the process of purchasing next generation sequencer to perform the highest level of resolution for HLA typing. The second main issue that the HLA lab faces is the deceased donors on call especially after routine lab hours. This is a tremendous amount of work and need to be performed in a timely manner to avoid the total organ ischemia time. In order to solve this challenge, we successfully received a fund from the St. Paul's Foundation to purchase a Real Time PCR to speed up HLA typing for deceased donors. This will speed up HLA typing from 6 hours to 2 hours and will limit total organ ischemia time that will result in higher successful transplantation.

Ongoing Issues: A special request from the bone marrow transplant team is to bring the chimerism testing back from the Manitoba HLA lab. This technique is used to reflect the bone marrow engraftment efficiency. The turnaround time is very important as in most cases its lifesaving. Currently the test is done in Manitoba and the turnaround time is 21 days. As soon as the HLA Lab receives the Real Time PCR, we will start validating the technique and get it approved by ASHI. We anticipate the turnaround time will be 3 days. Based on last year, we sent over 350 samples to Manitoba HLA lab. By bringing the test back to Saskatoon, this will save a lot of expenses.

Issues which are not resolved: Since the HLA is a 24/7 service, the Lab Director need to be on call for all time that the lab is offering the service based on the ASHI guidelines and standards. This is very important for the patient safety and efficient reporting. The Lab Director is not offered any compensation for doing on call work after paid hour, unlike all other pathology faculty and HLA lab directors in other provinces.

Roy Romanow Provincial Laboratory
Dr. Nick Antonishyn, MSc, PhD, FACMG, FCCMG

Patient Care Mandate

- I have volunteered to assist with the College of Medicine Multiple Mini Interview process
- Proposed and implemented Genetics Resource Centre – provincial in scope
- With requisition review and follow up – addressed a service gap
- Helped with patient wait times by making genetics clinic more efficient
- Standardization and efficiencies -> cost savings
- Elimination of unnecessary or incorrect tests
- Repatriated several molecular genetic tests at RRPL
  - Hereditary Cancer
  - Hemochromatosis
  - Fragile X
- These returned tests are less expensive and often much faster than out-of-province send-out alternatives

Teaching

- Molecular diagnostics at RRPL has recently become part of the MLT CSMLS competency profile – it is now a required course. We are accommodating student training and providing hands-on laboratory time.

Research Mandate - Future plans

- Proposed expansion to Maternal Serum Screening
  - Addition of cell-free DNA for enhanced non-invasive prenatal screening - SBAR submitted (docs attached)
- Proposed expansion of Newborn screening
  - SCID – SBAR submitted (Docs attached)
  - CMV – and other hearing loss targets – SBAR planned for 2020 with Paul Mick and Jessica Minion
  - Thalassemia and Hemoglobinopathies Carrier Screening – SBAR in draft mode with Donna Ledingham
  - SMA – waiting for above first

Perceived obstacles

- Funding for capital equipment, FTE reallocation and “start-up” funds for method validation – despite proposals that show ‘savings’ to the overall health-care system.

Northern Laboratory Services
Dr. Bruce Murray and Brandi Keller

Saskatchewan's North covers over one-half of the province's geography, and essentially includes all facilities North of Saskatoon. As well, although not part of the Saskatchewan Health Authority, many Athabasca Health Authority Laboratory specimens are processed in northern SHA laboratories.

There are significant, unique challenges presented by this large area and the scattered, sparse population it holds. The diversity of the population is one of those, with a large population of Indigenous peoples who face a high burden of health challenges as well as significant barriers to access from both a cultural perspective and the long distances for travel and communication.

These distances, and small population base mean that not all laboratory testing is available in the North and must be done in more urban areas and thus we are constantly faced with challenges to timeliness of transport and viability of specimens. Coordination of testing, communication and transportation are of paramount importance in order to provide timely and accurate data for our patient population.

Laboratory Services are provided at 3 regional hospitals, 4 district Hospitals, 10 community hospitals, 21 health centers and numerous collection centers, generating 4.9 million tests results annually. The test volumes subtended by the North represents a disproportionate challenge to ensure the right tests are available at the right place at the right time for the appropriate purpose.

These laboratories provide testing in all of the major clinical subspecialties including Biochemistry, Hematology, Transfusion Medicine and Point of Care. Microbiology testing is performed in North Battleford, Tisdale and Prince Albert, and Anatomical Pathology is located North Battleford and Prince Albert. The scope of testing includes both primary and secondary testing while tertiary testing (genetic, molecular, and specialized) is referred to the major urban facilities in Regina and Saskatoon.

Human Resources:

The current designated number of pathologists within the North include 4 FTE's split between North Battleford and Prince Albert. Currently 2.5 of the 4 FTE pathologist positions in the North are filled, with active recruitment being pursued both locally and with support from our provincial Practitioner Staff Affairs leadership.

There are currently 234.10 FTE Allied Health Care Professionals in the North, including Medical Laboratory Technologists, Combined Laboratory and X-Ray Technologists, Medical Laboratory Assistants, Phlebotomists, Medical Office Assistants and Unit Clerks. 17.66 of these positions are currently vacant and recruitment efforts to fill these "hard to recruit" positions are underway.

Medical Leadership:

Medical leadership has been allocated to a 0.4 FTE.

Leadership for Laboratory Medicine in the North is under the direction of the Director of Laboratory Medicine, North and the Area Medical Lead for North East and North West, and operates as a dyad model. This dyad relationship has proven to be successful in the provision of laboratory services in the North. By taking advantage of opportunities for meeting in person with clinicians and staff, through Medical Advisory Committee meetings, Physician Advisory Committee meetings, as well as interfacing with facility staff through site visits and video/teleconferencing opportunities.

It has been found that the face-to-face meetings are greatly appreciated by staff and clinicians and have provided a valuable opportunity for communication with all stakeholders. The clinical staff is most appreciative of discussion on test menus and testing strategies including new and innovative testing methods and instrumentation such as Point of Care Testing.

Supporting Documents:

- Rosthern Medical Staff Meeting Minutes January 2020
- Laboratory Operations Rosthern Hospital January 15 2020

The northern laboratories also liaise with, and are provided with support, from the clinical subspecialty experts through the Provincial Discipline Specific Committees (Biochemistry, Hematology, Transfusion Medicine, Microbiology, and Anatomical Pathology). Site visits to rural laboratories from the clinical staff to numerous Northern sites have been completed over the last year.

Supporting documents:

- Biochemist Site Visits January 2020
- Microbiology Site Visit Prince Albert April 2019

Shortfalls in Medical Human Resources can result in significant challenges in providing support to clinical services, both Acute and Primary Health Care.

Laboratory operations are also entirely dependent on having the correct number of Allied Health Professionals in all of the geographic areas and facilities within the North.

Administrative support is essential to establish and support the expanded portfolios of the administrative and clinical staff in Laboratory Medicine. Funding of administrative support continues to be problematic.

Perceived obstacles (Gaps) and Potential Remedies:

Transportation

The turnaround time of laboratory testing is critical to patient care and safety in rural and remote facilities. Due to transportation constraints throughout the North, there are occasions when testing does not meet the expected timelines of the clinicians or may even be rejected due to extended transport time. (CD4/CD8 – an important test for immunosuppression in HIV patients in some our most vulnerable Northern clients.)

Potential Remedies:

A provincial approach to transportation challenges is in progress.
Consideration of current state and future state test menus.

Supporting documentation:

- North Route Saskatchewan Health Authority-Briefing Note

Laboratory Information System (LIS) connectivity
In order to meet the needs of clinical service providers and enable electronic access to laboratory results via EMR, along with the advent of MySask health record, the lack of Laboratory Information System (LIS) connectivity has become a major risk. In the North there are currently two, 24-hour acute care facilities and eleven other smaller laboratories that are not connected to the LIS. This lack of connectivity puts an already vulnerable population at further risk.
Potential Remedy:
LIS connectivity prioritization in progress. 13 acute care sites prioritized for LIS connectivity.

Aging Equipment and New Technology

There is an ongoing need to replace aging equipment and purchase new technology. New and emerging technologies are continually on the market and laboratory equipment is costly. Rural laboratories have had to rely heavily on local foundations to support equipment purchases.

Potential Remedy:

Coordinated planning and identification of risk on aging equipment and technology.

Point of Care (testing at or near the patient location) options are available and will be an important consideration in future planning of clinical laboratory services.

Human Resources:
Human Resources continue to be an ongoing challenge in rural, and remote, in particular, the North.

Potential Remedy:

Coordinated efforts through the provincial Department have become easier to identify needs. Consideration of a hub and spoke model to support rural and urban facilities is in progress as well as different approaches to physician training within our residency program that may lead to improved recruitment across the province.

A concerted effort for allied health professionals with educational facilities is in progress. Recruitment from rural areas and training in rural sites is under consideration and planning.

Future Planning

In order to ensure clinicians receive high quality, timely results that meet the needs of the patients in Northern Saskatchewan –numerous improvements are in progress:

- •Rural Laboratory Strategy. Identification of the current state and future state recommendations on laboratory services, with consideration of a hub and spoke model.
- •Continued site visits by dyad to identify gaps with rural clinicians.
- •Future interface between lab services and clinical program planning efforts.
- •Repatriation of testing/decentralizing testing as appropriate. Consideration of Point of Care Testing.
- •Continued collaboration with the discipline committees to help identify the “gaps” and find remedies.

College of Medicine

The health care environment in the North, with its unique character and challenges, also provides significant opportunity for innovation and study. From test utilization and appropriateness to the implementation of new instrumentation and testing strategies, all require both basic and applied research techniques to ensure that solid, evidence-based practices are maintained. It can also provide all undergraduate and postgraduate students numerous opportunities to thoughtfully examine the practices in the North and help with the continuous improvement of SHA services.

We feel that the preceding has described both current state and plans for future development of Northern Laboratory Services and provides a microcosm of the goals and challenges of the provincial laboratory services as a whole. A provincial approach with strong leadership has laid the groundwork for a responsive, sustainable laboratory service within Northern Saskatchewan. We plan to continue to build on the strengths developed over last two and a half years, with a continued analysis of the needs of our patient population to ensure appropriate laboratory support is available. As well, we will continue to take advantage of new treatment and testing strategies that will provide quality care to the patient populations we serve.

The laboratories in the North have seen many improvements since the transition to a single health authority, the collaboration and communication within the provincial program across the province has already improved the services remarkably, and we foresee only further successes in our future.

Rural Laboratory Services
Tammy Mason, Director, Rural

Current Laboratory Services in the South:

Saskatchewan's Rural (South) Laboratory Services essentially includes all facilities south of Saskatoon. There are 88 facilities with Laboratory Services provided at 3 regional hospitals, 5 district Hospitals, 28 community hospitals, 52 health centers.
These laboratories provide testing in all of the major clinical subspecialties including Biochemistry, Hematology, Transfusion Medicine and Point of Care – though not all subspecialties are provided at every site. Microbiology testing is performed in Moose Jaw and Yorkton, while Anatomical Pathology is located only in Moose Jaw. The scope of testing includes both primary and secondary testing while tertiary testing (genetic, molecular, and specialized) is referred to the major urban facilities in Regina and Saskatoon.

Human Resources:

The current designated number of pathologists within the South include 2.0 FTE's, both are in Moose Jaw.

There are currently 269.41 FTE Allied Health Care Professionals in the Rural, including Medical Laboratory Technologists, Combined Laboratory and X-Ray Technologists, Medical Laboratory Assistants, Phlebotomists, Medical Office Assistants and Unit Clerks. 24.21 FTE are currently vacant and recruitment efforts to fill these "hard to recruit" positions are and have been underway for some time now.

Medical Leadership:

Leadership for Laboratory Medicine in the South is under the direction of the Director of Laboratory Medicine, South and operates as a dyad model (which has not been fully secured yet).

The southern laboratories liaise, and are provided, with support from the clinical subspecialty experts through the Provincial Discipline Specific Committees (Biochemistry, Hematology, Transfusion Medicine, Microbiology, and Anatomical Pathology).

Perceived obstacles (Gaps) and Potential Remedies:

1. Laboratory Information System (LIS) connectivity

The lack of Laboratory Information System (LIS) connectivity has become a major risk. In the South there are currently ten (10) 24-hour acute care facilities with no LIS connectivity and an additional four (4) acute sites that do not have coagulation interfaced. There are multiple health centers that are performing testing with either no LIS or have a depot location. This lack of connectivity puts an already vulnerable population at further risk.

Potential Remedy

LIS connectivity prioritization in progress. The acute care sites have been prioritized for LIS connectivity.

2. Aging Equipment and New Technology

As identified in the north report, there is an ongoing need to replace aging equipment and purchase new technology. Rural laboratories have had to rely heavily on local foundations to support equipment purchases. Oftentimes, there is no backup in even the larger rural centers, and this can create problems when equipment goes down. In addition, service is not always immediate due to "higher priority" of urban sites, so oftentimes, equipment can be down for >24 hours, which leaves us at the mercy of the courier and transportation systems.

Potential Remedy

Coordinated planning and identification of risk on aging equipment and technology. Point of Care (testing at or near the patient location) options are available and will be an important consideration in future planning of clinical laboratory services.

3. Human Resources

Human Resources continue to be an ongoing challenge in rural. We are doing our best to encourage new hires to be located in the acute sites in an effort to maintain our 24 hour emergency facilities to remain staffed – but we cannot make someone work where they don't' want to live or work.

Potential Remedy:

We have been working on a hub and spoke model to support rural facilities but coordination with unions can at times be somewhat challenging. Even though we are 'one' now, it is all but impossible to have staff 'cross' the union borders at times (whether it is different locals or entirely different unions – i.e. SEIU/CUPE).

Success of Rural Team:

Thus far, a huge success we have seen is that we are "one", and as such, there is so much more collaboration with everyone. This includes staff, supervisors, managers, clinicians, and disciplinary support. The rural struggle with medical leadership is huge, and having someone to call when we need medical oversight is very helpful. We have a long way to go, but we already feel the support and appreciate it very much.

Challenges of Rural Team:

One of the biggest challenges is the rural is the number of sites that perform testing. We have 52 health centers in the rural south that 95% of them perform some level of testing at. It is at times difficult to maintain competency for some staff when the testing volumes are low and the reporting method is either via paper, or manually entering into the LIS depot site. There are huge safety concerns with this challenge

Rural Living Rewards:

These are huge! There is no greater reward than to live in the rural. We have experienced staff who are knowledgeable and proud of what they do and who know on a personal level the clients and residents that they deal with on a daily basis. The personal connections are definitely higher in the rural because the same people we are connecting with during the day are the same people we are playing hockey with in the evening, or meeting at the grocery store. This puts more than just a number to the specimen – this gives us a reminder that there is a body – and more than likely someone we know – attached to that specimen.

One Wish for Rural:

A wish for the rural would be more standardization - in our processes, in our equipment, and in our testing menus. And with that, to have consistent support for everything that we do. While indicated above that the support has improved, we are by no means where we need to be. And oftentimes, the rural does not have the technical expertise needed to move some priorities forward nor have we had the opportunity to build trust relationships with leadership in urban. This will take time, and I do believe we have made huge strides. I look forward to continuing forward with the momentum we have gained thus far.

Provincial Clinical Biochemistry
Dr. Andrew Lyon, PhD, FCACB, DABCC

Clinical Biochemistry tests represent 70% of all clinical laboratory procedures in the province and are performed in local laboratories, high volume regional/provincial laboratories and at patient bedsides by nursing staff within point-of-care programs directed by biochemistry personnel. The scope of biochemistry services includes urgent tests (e.g. oxygen), biomarkers of myocardial infarction (e.g. troponin) and routine tests such as pregnancy biomarkers, tumor markers, allergy, immunology and nutritional biomarkers as well as hormones and metabolites used for endocrine disorders such as diabetes. In addition to directing laboratory staff, the service offers clinical consultations on patient results, assurance of lab quality, maintenance of accreditation readiness, selection and evaluation of instruments, investigation of safety alerts, as well as teaching and research roles for both the College of Medicine and SHA.

Challenges: Planning: Medical and Scientific leadership for clinical biochemistry is provided by a joint labor pool of medical biochemists, certified clinical biochemists and general pathologists. It remains a challenge that the SHA and College of Medicine use language and policies that assume leadership is only provided by MDs (such as the guideline for this report, exclusion of certified clinical PhDs from ACFPs, exclusion of certified clinical PhDs from SHA practitioner bylaws). Formal pathology and lab medicine provincial work force planning included both MDs and PhDs and both classifications are recognized by the ministry of health and SAHO.

Recruitment: In the past 4 years, 50% of preferred PhD candidates rejected offers, two PhD left for positions outside of SK, one PhD position is now unfilled and one MD position has interviews scheduled. Lack of success is due in part to use of a 2016 SAHO grid that is now 10-20% lower than scales used in Manitoba, Alberta and B.C.

Diversity: The seven filled positions included 3 women and 4 men and is a diverse group of generalists.

Clinical Service Gaps - Staff: 1. Rural Services Biochemist (0.5 FTE). No personnel are currently designated to provide service outside of Regina and Saskatoon (urgent requests with patient impact are handled). 2. Biochemical Geneticist. Position with JPCH service unfilled for 3 years. No provincial resource to oversee newborn screening programs. 3. Clinical Toxicologist. Large demands for addiction and substance abuse testing are currently centralized with growth ~15% per year, with excessive test utilization (>90,000/yr).

Clinical Service Gaps- Equip: 1. Metabolic Disease Lab to enable in-province diagnosis of disorders detected by newborn blood screens. This gap relates to inability to recruit a biochemical geneticist. 2. Clinical Toxicology Lab-North. To address the ongoing needs for substance abuse testing (methamphetamines, fentanyl, etc) and share the large workload, develop a site in Saskatoon for routine and urgent assessment of drug exposures. 3. A lab utilization analytics service, to assess patterns of test use to detect excessive / inappropriate use and to target solutions that improve utilization and value. We have the data on test use, but we need resources for analyses and actions that are evidence-based.

Communication and Collaboration Gaps –Strong bilateral communication exists with emergency medicine, internal medicine, obstetrics, and cancer services. Communication should be improved with primary care networks and rural healthcare delivery.

Clinical Service Planning/funding: On a small scale, there are examples of successful targeted funding support for laboratory projects (e.g. pneumatic tube projects in Saskatoon). On a larger scale: There are unmet needs to start planning new laboratory space or separate lab buildings for both Royal University Hospital and Regina General Hospital to accommodate modern equipment specifications. Note: a separate tower for lab & pharmacy was removed from the plans for Jim Pattison Children's Hospital five years ago.

Physician and Scientist Clinical Payment Structures: SMA has been a poor representative for physicians that are not fee-for-service, such as pathologists. It is not clear how lab physicians can gain more effective representation. 2016 SAHO pay grid for scientists needs to be updated to be competitive. A system of sharing MD on call pay with PhD colleagues has merit, but formal contracts for on call pay need to be created and equitable across the province to serve both MD and PhD staff for the future. Currently HR has inconsistent reporting structures for clinical PhD staff in Regina and Saskatoon: In Regina the clinical PhD staff report to the medical biochemist and medical diecto/area lead, and in Saskatoon the clinical PhD staff report to the area lab director (as out-of-scope administrators) with informal reporting to the medical director/area lead The repoting structures should be consistent in the future.

Addressing gaps and challenges: The department has created an Executive committee consisting of dyad leaders for major lab disciplines. This committee was created a year after the formation of the SHA, rather than at its inception, but at least it has started and it has been very effective during the covid-19 pandemic management. In my opinion, creation of the executive committee will enable identification and remediation of service gaps. At this time, creation of a clear

structure, organization, roles and responsibilities and appointments for medical/scientific leaders has been delayed several times while priorities were given to establishing SHA lab directors and managers. It is not clear that the medical structure will be determined this year and it is likely that interim appointments will remain in place. This lack of commitment to lab medical structure extends to how laboratory services relate to zone medical organizations, which remains unresolved at this time.

Assuring quality and enabling quality improvement. The biochemistry discipline submits a quarterly quality report to the medical & administrative dyad to report on service delivery and quality. The utility and efficacy of this process is not yet known.

Local & National Service Quality Improvements:
-Completion of automated chemistry equipment replacement in Saskatoon hospitals 2018-2020.
-Pneumatic tube development for St Paul's Hospital 2020.
-Initiation of automated chemistry equipment replacement for Regina and RRPL 2020.

Biochemistry Medical and Scientific Staff Membership, May 11, 2020.

Bahera Mali, MD, FRCPath, FRCPC. – Regina
Joshua Buse, PhD, DABCC – Regina
Jay Kalra, MD, PhD, FRCPC, FCACB – Saskatoon
Andrew Lyon PhD, FCACB, DABCC- Saskatoon
Fang Wu, PhD, DABCC – Saskatoon
Barry Kyle, PhD, FCACB_- Saskatoon
Martha Lyon, PhD, DABCC – Saskatoon

Roy Romanow Provincial Laboratory and Public Health

Public health in Canada deals with some/all of the following:
- Population health assessment
- Disease and injury assessment
- Health promotion
- Disease and injury prevention
- Health protection
- Emergency preparedness response

The function of a public health laboratory is to offer support for these public health programs. The Provincial Public Health Laboratory Network (PPHLN) of Saskatchewan is an integrated part of the Saskatchewan Health Authority (SHA) overseen jointly by Laboratory Services and Population and Public Health. PPHLN is proudly based at the Roy Romanow Provincial Laboratory; however, public health testing occurs throughout the province and is delivered in an integrated manner by staff of SHA. The core responsibilities of the PPHLN of Saskatchewan align with the Canadian Public Health Laboratory Network (CPHLN) core functions and capabilities.

The Roy Romanow Provincial Laboratory and Public Health (RRPL), formerly the Saskatchewan Disease Control Laboratory, works to identify, respond to, and prevent illness and disease in the province.

The lab:

- Provides reference testing (other Saskatchewan labs send their specimens and cultures for verification and to provide more specific test results).
- Offers specialized screening and diagnostic testing.
- Conducts communicable disease detection, surveillance, infection control and prevention (currently RRPL is leading the initiative to provide COVID-19 testing).
- Tests and monitors water quality.
- Maintains laboratory standards and quality assurance regulations.
- Anticipates, detects and responds to outbreak of communicable disease, food-borne illnesses and pandemic threats.
- Facilitates and supports scientific research and training activities.
- Provides biosafety, containment, biohazard spill response programs.
- Serves as a centre for integrated disease and data management.
- Develops and evaluates public health policies.

To obtain more information about programs summarized below, please refer to the RRPL website:

1. Compendium of Tests - The Roy Romanow Provincial Laboratory Compendium of Tests provides:

   A list of tests performed at the Saskatchewan Disease Control Laboratory.
   Instructions for collecting and handling samples.
   Requisitions.
   What is new at RRPL?

2. Water Testing for the Public - Safe drinking water is important to all Saskatchewan residents. The Roy Romanow Provincial Laboratory has been testing water quality in the province for over 90 years.

3. Screening and Reference Services (Laboratory Services) - The Roy Romanow Provincial Laboratory provides the following screening and reference services:

   General chemistry (post-mortem and clinical toxicology services, fecal immunochemical test)
2. Newborn screening (neonatal testing)
   Prenatal maternal serum screening (assessing prenatal fetal status)

3. Colorectal screening

4. Clinical toxicology services

RRPL is also home to non-public health testing that supports the Regina area. This testing is overseen and directed by Laboratory Clinicians based at the Regina General Hospital

and Pasqua Hospital. RRPL is managed and supported through the Regina Area of the SHA.

Please see comment on COVID-19 and reports by Dr. Nick Antonishyn and Dr. Ted Alport earlier in this section and please consult Appendix 3 for more detailed information about operations in RRPL.

Section 4 – Teaching Mandate

Section 4 – Teaching Mandate

a) Briefly describe the department's teaching contributions in UGME.

In the past five years, the Department has expanded its undergraduate medical education (UGME) teaching contributions with an increased number of faculty members and a renewed commitment for Laboratory Medicine to have a greater presence in UGME at the University of Saskatchewan. The Department values UGME teaching and faculty members are encouraged to contribute to these activities. Currently there is no 'stand-alone' Laboratory Medicine course but Department members provide leadership and contribute to various health science courses, both in Saskatoon and Regina as listed in Appendix 4.

b) Briefly describe the departments teaching contributions in PGME.

The department hosts two residency positions in General Pathology (GP) per year, for a total of 10 residents. Departmental faculty are responsible for the training requirements for their five years of training. Please see report from the Program Administrator and CBD Clinical Leader and residents later in Section 4.

The report of the most recent accreditation by the Royal College is available in Appendix 4. In addition, selected Department members provide off service rotations for residents in Neurology and Neurosurgery (Neuropathology) Dermatology (Dermatopathology) and Obstetrics and Gynecology (Gynepathology).

c) Briefly describe the departments graduate education contributions.

Members of the Departments' Cancer Cluster are responsible for the educational oversight of 14 highly qualified individuals including three post doctoral fellows, three graduate students, two undergraduates and one summer student. Please see reports from Drs. DeCoteau, Geyer and Uppalapati. Other members of the department are responsible for up to 6 summer students.

d) Briefly describe the department's contributions to CBD both within and outside the department.

The general Pathology Residency is migrating to a CBD model as of 01 JUL 2020. Dr. Janine Benoit is the CBD Clinical Lead. A Clinical Competency Committee has been formed, comprising Drs. Banerjee, Benoit, Kanthan, Dokouhaki, Malejczyk and Mr. Harold Shiffman. In preparation for the move to CBD, the Department hosted two Strategic retreats to prepare faculty and students for this change (28 MAR 2018 and 27 MAY 2019.) Documentation dealing with these events and CBD onboarding are provided in Appendix 4.

To-date, Department members have not made contributions to CBD outside of our Department.

e) Briefly describe any other teaching contributions, including interdisciplinary teaching.

The Department is also involved in teaching programs of Sask Polytech (Medical Laboratory Technologist (MLT), Medical Laboratory Assistant (MLA), Cytotech and combined X-ray/Laboratory Technologist (CXLT) programs - hosting up to 20 students per year. Department representatives meet with Sask PolyTech Medical Diagnostic Department twice a year to review and collaborate on their programs and any concerns/ improvements recommended.

(Documentation concerning these programs is provided in **Appendix 4**). The Department also provides practicum rotations for students from the Masters Pathology Assistant Program from U of C and cytogenetic technologists from Michener College, UHN, Toronto.

Department faculty also contribute to courses in Pharmacy and to Mingling Minds and for the past three years the Department has contributed to the COM Open House Lecture Day for Grade 12 students - please see relevant documentation in Appendix 4.

The Department has made significant financial contributions ($35,246) to the creation of a Multidisciplinary Education Facility at Pasqua Hospital, Regina. Please see SBAR in **Appendix 4**.

The Department also hosts monthly Departmental Rounds - the presentations are determined by a Department Grands Rounds Committee. A copy of scheduled presentations in included in **Appendix 4**.

f) How is teaching monitored and reviewed in the department?

PGME resident faculty evaluations are gathered annually and pooled. They are vetted by residents and reviewed annually by the Department Head. Evaluations causing concern result in an personal interview between the faculty member and the Department Head.

UGME: student faculty and course evaluations are gathered annually and pooled. They are reviewed by the Department Head. In addition, selected faculty members provide peer evaluations for educators.

Teaching hours are monitored and reviewed by the Department Head at time of Assignment of Duties for all USFA faculty.

g) How is teaching recognized and valued in the department?

Teaching is valued and celebrated in the Department.

A Department Educational Committee has been created with the intent of promoting Education as a career for faculty members. Shortly to be expanded to provincial status.

Department members are encouraged to seek educational opportunities and/or enhance educational skills. To-date, the Department has supported two faculty members to attend Harvard Macy Courses and a third visit is planned for 2021. In addition, a number have been encouraged to consider obtaining additional qualifications in Health Care Education.

Our GP Residents are currently in the process of creating a Teaching Recognition Award for faculty members.

h) Briefly outline any challenges the department faces in meeting its teaching mandate.

The greatest challenge is the lack of clear contractual language to define that necessity of an academic mandate. The USFA contract does provide such contractual language but SHA contracts are at best ambivalent.

i) Briefly describe any departmental initiatives aimed at expanding the distributed model of medical education.

PGME: Our model of resident education, is based on distribution with available rotations for the GP residents in Regina and Prince Albert. In an attempt to enhance a community experience hope to add one site in Ontario and one in Alberta in 2020-2021. Faculty in Regina make a significant contribution towards UGME

education in that city (Dr. Malejczyk – MIP115). The Department has funded $35,246 towards the creation of a multi-disciplinary education facility at Pasqua Hospital. The Department also contributes to the University of Regina curriculum (BIOL 220, BIOL 490).

j) Briefly outline resident teaching performed by department members outside tertiary care settings.

Selected faculty members contribute to curriculum at Sask Polytech (curriculum of MLTs, MLAs and CXLTs).

Department Residents
Dr. James Macpherson
Chief Resident General Pathology
23 MAR 2020

This feedback is submitted on behalf of the residents of the General Pathology Program.

The resident group feels that the Department of Laboratory Medicine has many strengths as a department. Our program director, Dr. Banerjee, and our program administrator, Debbie Quirion, are always available and incredibly supportive of individual residents, and of projects we have undertaken as a group. Our department Head Dr. Magee is actively involved in supporting career development for residents, assisting in finding fellowship opportunities and arranging meetings between residents and the health region. All three of these individuals have also been important advocates for our program when it comes to securing funding for resident resources and activities.

The availability of funding is another important strength of the program. Through multiple endowment funds, residents have been able to purchase educational resources, and fund travel to conferences. We are always informed when new opportunities for funding arise, and are encouraged to pursue them.

In addition to the staff we have mentioned, there are many other attending physicians who regularly dedicate a great deal of time and effort to teaching residents. As new staff join the program, we do our best to engage them actively in resident education, and we feel that the quality of education we received has generally improved over time.

The implementation of the Competence by Design curriculum is seen as a weakness of our program. All of the residents see it as an important opportunity to improve the quality of teaching and evaluation received during our rotations. The current system of formative evaluation is sometimes less than ideal. Residents have received feedback which is not timely, not constructive, and not representative of their rotation as a whole. The CBD program can address many of these concerns. Unfortunately, many of our staff have been unable or unwilling to meet the new requirements for teaching, feedback, and formal evaluation.

The resident group is currently attempting to improve the curriculum for our academic half-days. Our goals are to make the content resident driven, with more representation of certain clinical pathology specialties, and with a focus on preparing us for our Royal College Examinations. We know that if our attending physicians are reluctant to implement these

changes we will not be able to achieve our goals. We are hopeful, but we feel that we have little recourse if our staff are unwilling to work together with us.

We see the centralization of the laboratory services at City Hospital as an opportunity to more easily communicate with and consult our attending physicians and other residents. That said, we are concerned that adequate space and resources for the entire resident group are not available at City Hospital in its current configuration.

The use of multi-head microscopes is an important part of our teaching. While we have the capacity for our current resident group at both RUH and City hospital, the microscopes and chairs at both sites are in need of improvement. We know that there are plans to improve the facilities at both sites, and that these microscopes are an important resource for the entire department.

We greatly appreciate this opportunity to provide the feedback to the department. We greatly appreciate the time and resources that the department dedicates to making our program as strong as it is.

Deb Quirion
Resident Program Administrator
18 FEB 2020

As the current Program Administrator (since 2014) for the General Pathology Residency Program my first priority is to ensure that our resident's get the best possible teaching during their five years that leaves them feeling confident when going to write their final Royal College exam. To have a healthy environment that is not only conducive to learning, but a comfortable atmosphere free of judgement, negativity and cherry picking.

My policy is always open-door; I inform all residents that I am always available if they have a problem, need to chat, or just need a moment. I would like to see our program reach outstanding status; where we have applicants wanting to be accepted into this particular program, and other off-service residents wanting to come here for electives.

Since I have been the Program Administrator we have overcome two external reviews by the Royal College; and by the second external review in 2016 we came out with an excellent standing. We are now completely accredited with no review until 2023 (which then is only internal but there are now new Accreditation Standards). Accreditation Survey Report and Memo **(Appendix 4)**.

Personally, I administrate two undergrad classes: Path 205 and Path 805. I feel it would beneficial for undergrad students to have more Pathology and Histology classes.

During the spring is when we start our rotation scheduling for the next academic year (which begins July 1 to June 30). Our General Pathology residents rotate through Anatomic Pathology (includes all sub-specialities, cytology, forensics, molecular), Biochemistry, Hematopathology, Microbiology and Research. Residents also have the option of completing six blocks of off-site electives at other educational institutions.

In the past when a resident was scheduled for an AP rotation (1 block/rotation = 4 weeks) they would be scheduled with two different faculty/preceptors for two weeks each in a rotation. For the upcoming academic year we will be trying to schedule by sub- specialty or service (i.e. Bone & Soft Tissue, Breast, Cardio, Dermatopathology, Endocrine, Gastrointestinal, Genitourinary, Gynecological, Head & Neck, Neuropath, Pediatric, Pulmonary, and Renal).

We try and balance out the time that each pathologist has a resident with them on service; which usually works out to between 4 to 6 two-week periods in an academic year. We also schedule faculty for our Academic Half Day which is every Friday; this works out to around two presentations per academic year. Although this will be taken over by the residents for this coming academic year as we are in the process of re- structuring the Academic Half Day schedule. Again into more resident driven and sub- specialty topics.

With that being said, I personally feel that within our faculty we have about half that are not keen on teaching and find having a resident more of a hindrance; rather than an opportunity. It should be looked upon as a chance to teach a junior resident, with the realization of having a senior resident (PGY4-5) that will be well prepared to assist pathologists. And then ultimately work as a junior pathologist in the final year of residency. When changes need to be made in the rotation schedule, sometimes it is a struggle to find replacement faculty. I also think that with the launch of CBD that our CP areas need more faculty supervision; I believe Biochemistry and Microbiology are lacking of faculty (we do currently have one faculty member on maternity leave in Micro). And as always, but more so for CBD, evaluations are the keys to success and learning.

Teaching evaluations are completed by the residents at the end of their rotation. At the end of the academic year I compile all evaluations into one evaluation for each faculty preceptor. They are then sent to the department head and then each faculty member will receive their evaluation. These are gathered in One45. The rotations are also evaluated using this method.

The pathologists work on a point system, and I am unaware if they receive less points in recognition of teaching residents. It is possible that this could be re-evaluated as I do not think that cases are distributed fairly. In the time that I have been here we have lost a few faculty members, but I believe we have gained more and at the moment our faculty count is at its highest.

It would be nice to have all teaching faculty on the same contract, or all the same amount of teaching obligation. There has been talks of adding an Anatomic Pathology program, as well as the General Pathology program. And because of this I believe some faculty decline to teach because it is a GP program and not an AP program. On this note, in the fall of 2018 I travelled with our Program Director and CBD Lead to Regina to meet with all departments and faculty. Again, I felt that Regina faculty have no inclination to teach residents and indicated they only hire “AP” trained residents. We went there to talk about the launch of CBD, and frankly all the entire faculty/department were interested in was telling us it should be an AP program not a GP. I’m not sure they understood that our Program Director cannot change the program from General Pathology to Anatomic Pathology. For being one University I feel the two departments (Saskatoon, Regina) are very divided and separated.

We are told that we are one cohesive group but I definitely do not feel that; you feel the divide between the University of Saskatchewan and Saskatchewan Health Authority.

Unfortunately, we have some faculty members that have no problem letting a resident know their disdain for the University. I know that grossing in the AP lab is particularly divided. The University of Saskatchewan specifically purchased a grossing hood for the residents because they weren't getting the time required for grossing. Still to this day the SHA does not allow access to our grossing hood, the residents are on a strict schedule and only gross on Mondays or Tuesdays when scheduled. SHA also does not like to have any of the grossing techs teaching the residents; or they would like to be compensated for the time. If the residents are using or have anything SHA property wise, then SHA will want something in return. The University of Saskatchewan pays an extraordinary amount for things that in the end either get taken from us by SHA or SHA is incorrectly recognized for the contribution.

In conclusion, I have been witness to great changes and planning in our General Pathology Residency program, I hope we stay on this road to greatness and become a better rounded program(s).

Janine Benoit MD , FRCP(C)
Department CBD Lead

I am pleased to assist with teaching with such a dedicated group of educators in the Department of Pathology. My teaching contributions pertain mainly to post graduate resident education (i.e. General Pathology Residency training program). During my 20-year career at the SCH site in Saskatoon, I have supervised the Pathology residents in their Cytopathology Rotation on a regular basis. An interest in education led me to sit on the Residents Program Committee (RPC) and over the years, I have participated in subcommittees as well as assist with the general RPC activities. CARMS matches have become a regular part of my yearly commitments.

The department, in combination with the College of Medicine, recently subsidized my attendance at the Harvard Macy Institute for enhancement of Education. This one-week course in Boston was very enlightening. I am grateful for the opportunity and feel that it prepared me to be further involved in Educational efforts in Saskatoon.

During the past several months, I have participated as the Competence By Design (CBD) Lead for the Department of General Pathology. This role has led to my contributions with setting up the CBD program for the residents in pathology and to prepare the faculty for enhanced coaching and feedback sessions. I have contributed to our departments' grand rounds to provide updates and education surrounding CBD. I am also the chair of the Competency Committee which regularly evaluates our residents in the CBD stream.

Outside of the Department of Pathology I have been asked to attend focus groups on resident education and to participate in planning a workshop for other CBD leads and program directors on coaching and feedback in resident evaluation. I look forward to further participation in these areas in the future.

I have enjoyed the ICRE national meetings which focus on education and intend to continue to attend these in the future.

Apart from residency education, I am also an advocate for technologists' participation in educational activities.

Dr. Anurag Saxena
Associate Dean, Postgraduate Medical Education

Involvement in undergraduate medical education

1. Teaching in 1st year and second year courses (Principles of Biomedical Sciences)
a. Neoplasia: (2015, 2016, 2017, 2018, 2019 ; fall of each year): 3 hours per year
b. Respiratory system: (2016, 2017, 2018, 2019, 2020 March of each year): 2 hours per year
c. Cardiovascular system: (2016, 2017, 2018, 2019, 2020 March of each year): 4 hours per year
d. Dermatopathology: (2016, 2017, 2018, 2019; April of each year): 1.5 hours per year

Involvement on postgraduate medical education

1. General Pathology residency program
a. Teaching in Hematopathology: 5 hours per year
2. Other residency programs
a. Teaching on various aspects (accreditation, leadership, learning environment, well-being): 20-25 hours per year.

Involvement in interdisciplinary teaching

1. Pathology for Physical Therapy students (PTH 805)
a. Course Chair
1. 2017- present
b. Instructor (2015, 2016, 2017, 2018, 2019): 3 hrs / session, 15 hours per year
1. Sessions on Introduction to Pathology, Cancer, Chronic Diseases, Neurological alterations, Inflammation and Repair.
2. Pathology for Health Professions (PTH 205)
a. Instructor: (2015, 2016, 2017, 2018, 2019): 1.5 hrs/ session, 12 hours per year
1. Sessions on Neoplasia (x2), Central Nervous system Disorders, Muscle disorders, Respiratory system, Bone and Joint disorders, Liver disorders, GI tract disorders.
3. Public Health Biology course (PBH 806)
a. Instructor: (2015, 2016, 2017, 2018, 2019): 3 hours/ session, 9 hours per year
1. Sessions on Introduction to Pathobiology, Diabetes and Cancer.

Involvement in faculty development

Sessions for Program directors on accreditation, continuous quality improvement in medical education, residents in difficulty, PGME processes**;** 2015, 2016, 2017, 2018, 2019, 2020: 4-6 years / year.

Grand Rounds on Competence By Design: 2016, 2017, 2018, 2019 (1 hour / round; 4 per year)

External Teaching

1. Workshops (facilitated / co-facilitated)

a. **Saxena A,** Smith-Windsor T. Residents in difficulty and teaching health advocacy. SaskRenewal workshop. Little Manitou Resort, Saskatchewan. Amy 15, 2016

b. **Saxena A**, Lawrence K. Integrating assessment of non-cognitive attributes /abilities in resident selection processes. (session on Oct 19) International Conference on Residency Education, Oct 16-21 2018, Halifax, NS.

c. **Saxena A**, Magee F. How to influence resource allocation work at the organizational level. (session on Oct 19) International Conference on Residency Education, Oct 16-21 2018, Halifax, NS.

d. **Saxena A**, Kanthan R, Premkumar K. APMEC 2019 CBD Symposium "Competency-based medical education: Assessment models" (session on Jan 12). Asia Pacific Medical Education Conference Jan 9-13, 2019. Singapore.

e. **Saxena A**, Lawrence K, Premkumar K, Reiter H. APMEC 2019 Admissions Symposium "Improving medical admissions for the 21st century" (session on Jan 21) Asia Pacific Medical Education Conference Jan 9-13, 2019. Singapore.

2. Invited Presentations

a. **Saxena A**, Invited panel member on "Future of Admissions" at the Inaugural "Admissions Summit." Organizer: Altus Assessments. June 10-11, Globe and Mail Centre, Toronto, ON.

b. **Saxena A**, St. Croix R, Burgetz S. Invited Research Forum on "Leader Developmental Readiness" to the Royal College of Physicians and Surgeons of Canada Administrative and Academic Leadership and workforce. May 27, 2019, RCPSC, Ottawa, ON.

Dr. John DeCoteau
Advanced Diagnostics Research Laboratory (ADRL)
23 MAR 2020

Academic Mandate

The ADRL contributes to excellence in cancer care through a robust R&D capacity that allows it to keep pace with cancer discovery and rapidly respond to the clinical demands for developing, validating, and implementing new companion diagnostics. The ADRL is also a key local resource that supports clinical trial activities; translational and patient oriented research; and the training of pathology residents, graduate students, and highly qualified technical personnel.

Some recent academic accomplishments of the ADRL include:

- **Support for High Quality Local Research Endeavors**

The ADRL supports a number of local clinical trial activities and translational research investigations, including ongoing projects in collaboration with Dr. Mark Bosch and Dr. Julie Stakiw funded by the Saskatchewan Cancer Agency and the Saskatchewan Center for Patient Oriented Research. These projects include improving methods to detect minimal residual disease in patients with diffuse large B-cell lymphoma, and investigating the role the bone marrow microenvironment plays in multiple myeloma development and disease progression.

A major multi-institution initiative to characterize POLE mutations in endometrial cancer is

being conducted in collaboration with Dr. Mary Kinloch, Head of Anatomic Pathology. This project is led by Saskatchewan and involves investigators from Vancouver, Calgary, San Diego, and England with mutational analysis for all centers performed at the ADRL. The endometrial cancer project has resulted in several presentations at international meetings; publications in high impact medical journals; and an opportunity for pathology resident Dr. Nick Baniak to obtain advanced subspecialty pathology training at Harvard.

- **Reference Laboratory to Support Multi-Institution Clinical Trials**

Growing recognition of ADRL infrastructure and expertise has positioned the lab to participate in national multi-centered clinical trials as a reference testing center. Most recently, the ADRL was designated a genomic profiling lab for the Canadian Cancer Trials Group 'Canadian Profiling and Targeted Agent Utilization Trial' alongside high profile labs such as the Michael Smith Genome Science Center in Vancouver; the Advanced Molecular Diagnostic Laboratory at Princess Margaret Cancer Center in Toronto; and Foundation Medicine Inc. in Cambridge, MA.

- **Training Center for Pathology Residents and Other Highly Qualified Personnel**

The ADRL provides excellent training opportunities for pathology residents and highly qualified medical laboratory personnel to gain expertise in modern molecular pathology diagnostic procedures. By offering structured rotations through the ADRL, the University of Saskatchewan is now one of a few pathology training programs in Canada that provides residents with hands on training experiences in high complexity diagnostics. Training opportunities offered at the ADRL will also help to fulfill Saskatchewan's future needs for highly qualified personnel, such as medical laboratory technologists with training in molecular pathology, and bioinformatics specialists.

- **Center for Biologic Imaging Research and Development (C-BIRD)**

The ADRL works closely with the Center for Biologic Imaging Research and Development (C-BIRD) directed by Dr. Ron Geyer. C-BIRD aims to develop the next generation of molecular imaging agents for three main purposes: early and definitive diagnosis; improved disease characterization; and guiding therapeutic interventions. The center focuses on biologic imaging research and development, and collaborates with industry, government, and academic researchers to advance molecular imaging agents and therapeutics from basic research to translation in patients.

PUBLICATIONS FROM LAST 5 YEARS – John DeCoteau, ADRL Medical Director

Refereed Journal Publications (Career total: 56)

Baniak N, Gilks CB, DeCoteau J, Kinloch M. Diagnostic Variation in p53 Usage for Endometrial Carcinoma Diagnosis: Implications for Molecular Subtyping. Int J
Gynecol Pathol. 2019 Sep 27 [Epub ahead of print]

Pastushok L, Fu Y, Lin L, Luo Y, DeCoteau JF, Lee K, Geyer CR. A Novel Cell-Penetrating Antibody Fragment Inhibits the DNA Repair Protein RAD51. Sci Rep, 2019 Aug 2;9(1):11227

Barreto K, Maruthachalam BV, Hill W, Hogan D, Sutherland AR, Kusalik A, Fonge H, DeCoteau JF, Geyer CR. Next-generation sequencing-guided identification and reconstruction of antibody CDR combinations from phage selection outputs. Nucleic Acids Res, 2019 May 21;47(9):e50

Baniak N, Fadare O, Köbel M, DeCoteau J, Parkash V, Hecht JL, Hanley KZ, Gwin K, Zheng W, Quick CM, Jarboe EA, Liang SX, Kinloch M. Targeted Molecular and Immunohistochemical Analyses of Endometrial Clear Cell Carcinoma Show that POLE Mutations and DNA Mismatch Repair Protein Deficiencies Are Uncommon. Am J Surg Pathol, 2019 Apr;43(4):531-537

Toosi BM, El Zawily A, Truitt L, Shannon M, Allonby O, Babu M, DeCoteau J, Mousseau D, Ali M, Freywald T, Gall A, Vizeacoumar FS, Kirzinger MW, Geyer CR, Anderson DH, Kim T, Welm AL, Siegel P, Vizeacoumar FJ, Kusalik A, Freywald A. EPHB6 augments both development and drug sensitivity of triple-negative breast cancer tumours. Oncogene, 37:4073-4093

Chekol R, Solomon VR, Alizadeh E, Bernhard W, Fisher D, Hill W, Barreto K, DeCoteau JF, Parada AC, Geyer CR, Fonge H. (Ch89)Zr-nimotuzumab for immunoPET imaging of epidermal growth factor receptor. Oncotarget, 2018 9:17117-17132

Alam MK, Alhhazmi A, DeCoteau JF, Luo Y, Geyer CR. RecA Inhibitors Potentiate Antibiotic Activity and Block Evolution of Antibiotic Resistance. Cell Chem Biol 2016 Mar 17;23(3):381-391

Yang Y, Sebra R, Pullman BS, Qiao W, Peter I, Desnick RJ, Geyer CR, DeCoteau JF, Scott SA. Quantitative and multiplexed DNA methylation analysis using long-read single-molecule real-time bisulfite sequencing (SMRT-BS). BMC Genomics, 2015 16:350-362

Refereed Conference Publications (Career total: 55)

Baniak N, Fadare O, DeCoteau J, Kobel M, Parkash V, Hecht J, Hanley K, Gwin K, Zheng W, Quick C, Jarboe E, Liang S, Kinloch M. POLE Mutations in Clear Cell Endometrial Carcinoma (abs#1135). Modern Pathology 2018; 31 (suppl 2): page# 406

Baniak N, Gilks B, DeCoteau J, McAlpine JN, Kobel M, Singh N, Casey L, Ganesan R, Kinloch M. Molecular Characterization of Recurrent Low Grade, Low-Stage Endometrioid Endometrial Carcinoma (abs#1136). Modern Pathology 2018; 31 (suppl 2): page# 406

RESEARCH FUNDING AWARDED LAST FIVE YEARS

DeCoteau J (Principle Investigator). Astra Zenca. Assay Development Grant: Validation study to implement liquid biopsy monitoring of the EGFR T790M resistance allele at the Advanced Diagnostics Research Laboratory. Description: One time unrestricted grant providing support to establish plasma monitoring of the EGFR T790M resistance allele by next generation sequencing of cell free DNA. Awarded: October 2019; $42,000 total

DeCoteau J (Principle Investigator). Saskatchewan Centre for Patient Oriented Research (SCPOR). Test Development Grant. Description: SCPOR matching grant program funded by CIHR and partners. The tests developed with this funding support translational and patient oriented research with an aim to enter the clinical arena in the near term. Awarded: May 2015; Active July 2015-June 2020; $500,000 total

Stakiw J and DeCoteau J (Co-Principle Investigators). Saskatchewan Cancer Agency Operating Grant: Role of the Bone Marrow Microenvironment in Multiple Myeloma Development and Progression. Description: New operating grant to assess minimal residual

disease and components of the bone marrow microenvironment in multiple myeloma patients using 10 color flow cytometry. Awarded: April 2017; Active: July 2017 to June 2019; $199,200 total

Bosch M and DeCoteau J (Co-Principle Investigators). Saskatchewan Cancer Agency Operating Grant: Predicting and Preventing Relapses in Non-Hodgkin's Lymphoma. Description: New operating grant to develop state of the art molecular monitoring tools for NHL patients using Next Generation Sequencing (NGS) analysis of plasma samples. Awarded: April 2016. Awarded: April 2016; Active: July 2016 to June 2018; $200,000 total

DeCoteau J (Principle Investigator). Alexion Pharma Canada. Assay Development Grant: 10 Color Flow Cytometry Assay for Monitoring Patients with Paroxysmal Nocturnal Hemoglobinuria (PNH); Description: One time unrestricted grant providing salary and reagent support to establish and validate PNH monitoring in Saskatchewan by 10-color flow cytometry. Awarded: March 2016; $30,000 total

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Dr. Ron Geyer
Teaching Deliverables

Through C-BIRD/STAR, I supervised one post-doctoral fellow (Wendy Bernhard), three graduate students (Ashley Sutherland, Darien Toledo, Mahsa Abrishami), one undergraduate student (Samantha Chomysen), and one summer student (Gabby Antaya). During the 2018-19 academic year, I graduated one PhD student (Mahsa Abrishami). Through C-BIRD, I also oversee the activities of one research associate (Kris Barreto) and one business development officer (Konstantine Sarafis).

I also co-direct a research program aimed at understanding the roles of circular RNA in cancers with Dr. Franco Vizeacoumar. In this program, I co-supervise one visiting scientist (Ling Wang), two post-doctoral fellows (Sharmilla Narayanan, Archana Kumari), and one undergraduate student (Justina Mchnee).

In ADRL, I oversee the activities of a research officer (Landon Pastushok) and next generation sequencing technician (Wayne Hill).

In total, I oversee the activities of **14 highly qualified people.**

Dr. Sheila Rutledge Harding
06 MAR 2020

a) Briefly describe the department’s teaching contributions in UGME.

- Up to 200 hours/year of direct student contact (lectures, small group seminars, clinical teaching, remediation, OSCEs); participation in the Admissions interview process and in the Medical Council of Canada Qualifying Examination, Part 2; chairing of various appeal committees.

b) Briefly describe the department’s teaching contributions in PGME.

- All General Pathology residents spend four weeks (full days) in Transfusion Medicine
- Most Anesthesiology residents spend one week (half days) in Transfusion Medicine
- Five days of Transfusion Camp are provided annually for residents in Pathology, Anesthesiology, and Emergency Medicine. This requires approximately 40 hours of Transfusion Medicine Physician time.
- Annual seminars for Rheumatology and Surgery residents

c) Briefly describe the department's graduate education contributions.
d) Briefly describe the department's contributions to CPD both within and outside the department.

- Most of our CPD contributions are through invited departmental rounds, within and outside the department.

e) Briefly describe any other teaching contributions, including interdisciplinary teaching.

- We participate in the teaching of laboratory technologists and nurses, locally, provincially and (for technologists) nationally. We have an annual provincial Transfusion Medicine symposium that is interprofessional and intentionally includes patients.

f) How is teaching monitored and reviewed in the department?
g) How is teaching recognized and valued in the department?
h) Briefly outline any challenges the department faces in meeting its teaching mandate.
i) Briefly describe any departmental initiatives aimed at expanding the distributed model of medical education.
j) Briefly outline resident teaching performed by department members outside of tertiary care settings.

- We are currently in discussion with the Program Director for Family Medicine to develop an appropriate educational package for FM resident province-wide, particularly in rural settings.

Dr. Jay Kalra
2015-2019

The self-study reflects my contribution and activities in various categories for the past 5 years (2015-2019).

1. Education/Teaching

- My contribution to teaching in various undergraduate (Med 115, Path 205, Clinical Skills III (Med 213.8): Review focused Interview and Physical exam (FIPE), Pharmacology teaching course PHPY 402.3, Professional Skills III Ethics MED 304.10) courses have been about 115 hours per year.
    - The evaluation for all courses taught have ranged from very good to excellent.

- This coming year, we will be introducing our course, Pathology 205, in the Biomedical Sciences Program. Much of the planning for the course curriculum has already been completed.
- Some of the teaching activities are as follows.

A. Undergraduate Teaching

- Coordinator, Education Division, Department of Pathology and Lab Medicine: Overall responsibility for all departmental undergraduate (Med 115, Pathology 205, Biomedical Sciences Couse-new-curriculum setting) educational programs
- Course Coordinator, Med 115: Revitalized the course and prepared course objectives, outline, etc. and teaching. Other faculty members including Dr. Kanthan and Saxena also teach this course. The course content has seen several changes including the addition of an interdisciplinary and integrated approach (Clinico-Pathological-Conference interdisciplinary) with the addition of case oriented teaching with a medical imaging component.
- Course Coordinator, Path 205: Prepared course objectives, outline, etc. and teaching. Other faculty members including Drs. Chibbar, McNair and Saxena also teach this course.
- Course, PHPY 402 Evidence –base Medicine and Evidence Based Lab Medicine.

Summer Students Supervised:

This activity provides the undergraduate medical and other student the opportunity to gain experience in research and scholarly work. Five Summer Students worked with me for summer 2019. Some of these students were funded through Dean's office.

Daniel Markewich, College of Medicine 3rd year, "An Assessment of Discordance between Autopsy and Clinical Diagnosis"
Patrick Seitzinger, UBC College of Medicine 3rd year, "Aging and Thyroid Function Testing"
Avani Saxena, Arts and Science 3rd year, "A Quality Perspective in Medical Error Disclosure"
Zoher Rafid-Hamed, Arts and Science 5th year, "Medical Error Disclosure – A Best Practice Model for Health Regions"
Daniel Hooshmand, Arts and Science 4th year "Ethnic minorities' experiences with health care professionals while living with and managing diabetes."

Summer Students for 2018 – **5**
Summer Students for 2017 – **6**
Summer Students for 2016 – **3**
Summer Students for 2015 – **4**

B. Graduate Students - The involvement in graduate studies have been about 80 hours per year.

Teaching

- Public Health Biology PUBH 806.3, "Inflammatory Processes – A Global View of Inflammation: It's Role in Acute and Chronic Disease"

Active Committee Membership

- Chair and Committee Member, Health Sciences Graduate program, Hanan Babekar Ph.D. Student "Development of small protein domain affinity reagents targeting biomarker, MUC16/CA125".
- Co-Supervisor, College of Pharmacy and Nutrition, Ashish Kopargaonkar M.Sc. Student, "Effect of Clinical Pathways on Interprofessional Collaboration and Patient Care: A Systematic Review".

External Examiner:

- External Examiner, September 2018. Masters of Fine Arts in Writing, Ms. Vijay Kachru, "Red Glass Bangles – *A Novella*", Department of English, College of Arts and Science, University of Saskatchewan. September 7. 2018
- External Examiner, September 2017, Master of Science (MSc.) Thesis, "Nurse Practitioner Impact: A Systemic Review and meta-Analysis", Ms. Laura Tremblay College of Pharmacy and Nutrition, University of Saskatchewan, Saskatoon, Saskatchewan

C. RESIDENT TEACHING

- Resident teaching includes Academic Half-Day, one-on-one teaching related to various modules in clinical chemistry for all residents training in general pathology, exam preparation, and resident evaluation etc. The teaching hours are about 105 hours per year**.**
- Examiner, Medical Biochemistry, Royal College of Physicians and Surgeons of Canada.

2. Practice of Professional Skills

Clinical Activities- My clinical activities in the division of medical biochemistry/clinical chemistry have been to cover various areas concerning patient care and administrative work related to healthcare delivery including but not limited to:

•Total Quality Management and assessment
•Quality Care and patient safety
•Services related to patients through Protein Electrophoresis module
•Various tests related to Endocrine and other modules
•Day-to-day activities in the division dealing with patient care issues
•Standardization of procedures
•Visiting various rural areas to enhance the quality of care delivery in regards to our test results
•Equal participation in the call schedule as 1 in 4 call

Member, Editorial Boards and Manuscript review
Member of 14 editorial boards including:

- American Journal of Biomedical Science & Research
- Journal of Pathology Clinical and Medical Research
- Madridge Journal of Cardiology (MJC)
- Journal of Biomarkers and Applications
- Pathology and laboratory medicine
- Journal of clinical and Laboratory Medicine
- Pathology and Laboratory Medicine
- Annals of Clinical Pathology
- Austin Journal of Pathology & Laboratory Medicine

- Clinical Biochemistry
- Pathology Insights (PI)

Manuscript Review for Journals

Average 10-12 papers reviewed per year from various journals.

Continuing Medical Education

I have attended and presented at various continuing medical education activities. Typical examples are as follows.

o Presented. Ophthalmology Grand Rounds "Quality Care and Patient Safety: Medical Error Disclosure -A global View", February 02, 2018. Eye Center Library, Saskatoon City Hospital, Saskatoon, SK, Canada

o Presented**.** Pathology Grand Rounds "Total Quality Management: A New Era in Patient Safety and Medical Error Disclosure", March 26, 2018. Royal University Hospital, Saskatoon, SK, Canada

o Attended, Western Canadian Universities. Big Data Health Conference "The future of precision health and Big data", Sep 28-29, 2017, Banff Center for Arts and Creativity, Banff, Alberta, Canada.

o Attended, American Society for Quality (ASQ) Canada Conference, "A Confederation of Quality Professionals Working Toward an Inclusive and Sustainable Canada", Sep 25-26, 2017, Canada War Museum, Ottawa, Ontario, Canada.

o Attended, U of S Canada 150 Forum on the future of healthcare in Canada. Convocation hall, Peter MacKinnon Building, Saskatoon, Canada. September 18, 2017.

o Attended, Society for College and University Planning (SCUP) Annual International Conference, July 8-12, 2017, Marriott, Washington DC.

o Attended, "PD-L1 Assay- New Biomarker in pathology Practice" (Dr. Iryna Shnitsar and Dr. Chris Carter), Saskatoon, SK, May 5, 2017.

o Attended, Physician Leaders as Stewards of healthcare". Canadian Conference on Physician Leadership, Vancouver, BC, April 28-29, 2017

o Attended, "Influencer", Canadian Conference on Physician Leadership, Vancouver, BC, April, 26-27, 2017.

o Attended, "Rethinking Access; when non-traditional is the new normal". Higher Education Quality Council of Ontario, Annual Conference, Toronto, ON, April 19-20, 2017.

o Attended, "your patient, your practice: Practical Tips for safe care session", Continuing Medical Education Certificate, Canadian Medical Protective Association (CMPA), Saskatoon, SK, April 5, 2017.

o Attended, Saskatchewan Economic Summit, The conference Board of Canada, Regina, SK, April 3, 2017.

o Attended, "CSCC MGWG Protein Electrophoresis Reporting Recommendations". Canadian Society of Clinical Chemist (CSCC), Canadian Monoclonal Gammopathy Interest Group (MGIG), consensus meeting and consensus recommendation working group, Toronto, ON, March 25, 2017.

o Attended, "Building reconciliation Forum", University of Saskatchewan, Saskatoon, SK, March 7, 2017.

o Attended, "Highlights in Biomedical Environmental and cardiopulmonary Research", Multi-cluster Research Day, University of Saskatchewan, Saskatoon, SK, March 3, 2017.

o Attended Post- Secondary Leadership forum TCU Saskatoon organized by Ministry of Advanced Education, Government of Saskatchewan, Saskatoon, October 17-18, 2016

o Attended, International Conference on Residency Education by Royal College of Physicians and Surgeons, Canada, September 28-October 1, 2016, Niagara Falls, ON
o Attended, End-of-life care and medical assistance in dying course by Canadian Medical Association, November 3-5, 2016, Toronto, ON.
o Attended, "Copyright in teaching: What can you use? Session by Ryan Banow and Kate Langrell, University of Saskatchewan, Saskatoon, SK, August 30, 2016.
o Attended, Webinar on Integrating Clinical Decision Support and Patient Engagement in Value-Based Lab Services, by American Association of Clinical Chemist (AACC) to obtain the ACCENT Continuing education credit. July 06, 2016.
o Attended, "ISO 2015 upgrade course administered by the American Society for Quality, Saskatchewan Section, Edward School of Business, University of Saskatchewan, Saskatoon, SK, July, 2016.
o Attended and completed, Advancing Safety and Patient in Residency Education (ASPIRE) workshop, Canadian Patient Safety Institute (CPSI), Ottawa, May 10-13, 2016
o Primary Healthcare and Primary Care Medicine, Session Chair- Annual Congress and Medicare Expo on Primary Healthcare, Dubai, UAE. April 25-27, 2016
o Laboratory Integration, Symposium 12, Chair- 42st Annual Conference of Association of Clinical Biochemists of India (ACBICON) 2015. Organized by Postgraduate Institute of Medical Education and Research (PGIMER), Department of Biochemistry, Chandigarh, India. November 26-28, 2015
o Attended, Leadership Strategies for sustainable Engagement, PMI Leadership Development for Physicians PMI physician leadership courses, Saskatchewan Medical Association, Saskatoon, October 16-17, 2015
o Attended, Physician as Coach, PMI Physician Leadership Courses Jun 5-6, Saskatchewan Medical Association Jun 5-6 2015
o Attended, Patient oriented Research (POR): Saskatchewan Style**,** A workshop for patients, clinicians, researchers, & policy-makers Monday, May 25, 2015 Saskatoon Health Sciences E wing Room 1150
o Attended, Organizational Excellence Workshop, Dawn Ringrose Organizational Excellence Framework - ASQ Saskatchewan Section University of Saskatchewan March 15, 2015

3. Research and Scholarly Activities

My research/scholarly work focuses on establishing the best practices and guidelines for quality care and patient safety, medical error and disclosure policy, total quality management programs, and laboratory utilization in health care. My research/scholarly work has revolved around the following topics:

•Laboratory Utilization in Healthcare
•Medical Error & Disclosure of Adverse Events
•Ethical Issues surrounding Medical Error Disclosure
•Total Quality Management in Laboratory Medicine
•Quality Assessment – Discrepancy rate between clinical and autopsy diagnosis

With the limited protected time (5-7%), I have been able to publish several peer-reviewed articles in an array of journals. I have authored a book entitled "Medical Errors and Patient Safety – Strategies to Reduce and Disclose Medical Errors and Improve Patient Safety" and have been leading as a champion in establishing a non-punitive "no-fault model" to address

clinical/medical errors, and in developing educational programs and clinical guidelines reflecting evidence-based medicine.

A. Publications

BOOKS, CHAPTERS IN BOOKS, AND PEER REVIEWED PUBLICATION:

i) Books

- **Kalra J.** 2011. "Medical Errors and Patient Safety – Strategies to Reduce and Disclose Medical Errors and Improve Patient Safety." Walter de Gruyter GmbH & Co. KG, Berlin/New York, 2011
- Lightner, N. J., **Kalra, J**., (Editors). Advances in Human Factors and Ergonomics in Healthcare and Medical Devices. Springer Nature Switzerland AG 2020. Proceedings of the AHFE 2019 International Conference on Human Factors and Ergonomics in Healthcare and Medical Devices, July 24-28, 2019, Washington D.C., USA.

ii) Chapters in Books

- **Kalra J**., Saxena A., Rostampour N., Vantomme E. 2018. Aging and Functional Changes in Polymorphonuclear Leukocytes. In: Lightner N. (eds) Advances in Human Factors and Ergonomics in Healthcare and Medical Devices. AHFE 2018. Advances in Intelligent Systems and Computing, Vol 779. Springer Cham, p 308-318.
- **Kalra J**., Nayar A., Nogier K., Kopargaonkar A. 2018. Quality Management in Healthcare: Assessment Tools in Clinical Diagnostic Laboratories. In: Arezes P. (eds) Advances in Safety Management and Human Factors. AHFE 2018. Advances in Intelligent Systems and Computing, Vol. 791. Springer Cham, p 91-97.
- **Kalra J**, Sachdeva R, Baniak N. 2015. Pathology- Career as a Detective In book Pathology for the Curious: Why Study Pathology? (The Truth about your College Major, Research, Scholorships, and Career Success.) Kindle Edition. (ISBN 978-1-925128-54-3), Copyright 2015, Curious academic publishing

iii) Peer Reviewed Publication

I have been involved in publishing manuscript as an author/co-author with various students, resident and colleagues who have worked with me. Some typical examples are as follows:

- **Kalra J.,** Rostampour N., Sagi M., Seitzinger P. 2018. The Role of Oxidative Stress and Apoptosis in the Pathogenesis of Heart Failure. Arch Clin Pathol J. 1:1-4
- **Kalra J.** 2018. Refinement in Healthcare: Need for an Innovative Quality Management System. Res Trends Lab Med Pathol. Vol 1:1-3. RTLMP-102. DOI: 10.29011/ RTLMP-102. 100002
- **Kalra J**, Kopargaonkar A. 2017. Quality Care and Patient Safety: Strategies to Disclose Medical Errors. In: Duffy V., Lightner N. (eds) Advances in Human Factors and Ergonomics in Healthcare and Medical Devices. AHFE 2017. Advances in Intelligent Systems and Computing, vol 590. P159-167 Springer cham
- **Kalra J**, Vantomme E, Rininsland V, Kopargaonkar A. 2017. Medical Error Disclosure: Mandate in Quality care and Patient Safety. Internal Med Review. 1(1) p 479-493
- Booth RA, McCudden CR, Balion CM, Blasutig IM, Bouhtiauy I Rodriguez-Capote

K, Catomeris P, Chan PCChen Y, Collier C, Hauff K, **Kalra J**, et al.2017. Candidate recommendations for protein electrophoresis reporting from the Canadian Society of Clinical Chemists Monoclonal Gammopathy Working Group. Clin Biochem, 50:10-20

- **Kalra J**., Kopargaonkar A. 2016. Quality Improvement in Clinical Laboratories: A Six Sigma Concept, Pathol Lab Med Open J. 1(1):11-20.
- **Kalra J**., Mulla A, Kopargaonkar A. 2016. Diagnostic value of Vitreous Humor in Postmortem Analysis. SM J Clin Pathol. 1(1): 1005 -1009.
- **Kalra J**., Adams SJ. 2016. Medical Error and Patient Safety: Fostering a Patient Safety Culture. Austin Journal of clinical path. 3(1): 1041-43.
- **Kalra J.** 2016. Medical Error Disclosure: A Point of View. Pathology and Laboratory Medicine. 1(1): e1-e3.
- **Kalra J.** 2016. The Role of Primary Healthcare in Disease Management. Primary Health Care, 6: 2167-1079.
- **Kalra J,** Macpherson J**. 2015.** Quality Improvement through Medical Error Disclosure and Autopsy Findings, Austin J Pathol Lab Med. 2(1): 1015-16.
- **Kalra J,** Entwistle M. 2015. Re-Examining the Relationship between Medical Error Disclosure and Patient Safety. Austin J Pathol Lab Med. 2(2): 1027-29.
- **Kalra J,** Macpherson J. 2015. The Decline of the Hospital Autopsy: A Missed Opportunity for Quality and Education in Healthcare. Austin J Pathol Lab Med. 2(1): 1024-26.
- Baniak, N., Campos-Baniak, G., Mulla, A., **Kalra, J.** 2015. Vitreous Humour: A Short Review on Post-mortem Applications. J Clin Exp Pathol. 5(1): 1-7

iv) Published Conference Proceedings and Abstracts- Approximately 4-5 abstracts per year. Typical abstracts included in the area of medical error, evidence based medicine, quality care and patient safety, quality management and assessment, medical error disclosure and ethical issues. These abstracts were authored/co-authored with various students, residents and colleagues. Some typical examples are as follows:

- Vantomme E, Tsui C, Chetty K., Rininsland V, **Kalra J**. 2019 Medical Error: An Evidence-Based Model for Effective Disclosure to Improve Patient Safety. Medical Education Research and Scholarship Day. March 22, 2019. Regina General Hospital Learning Centre. Research abstract
- **Kalra J.,** Trends in Medical Error Disclosure and its Implications – A Global View. 2019. 8th Annual Meeting of Indian Academy of Biomedical Science & Conference on Deliberation on Translation of Basic Scientific Insight into Affordable Healthcare Products. National Institute for Interdisciplinary Science & Technology. Thiruvananthapuram, Kerala, India. Abstract Proceedings, Pg. 31.
- Markewich D. **Kalra J.** 2019. An Assessment of Discordance between Autopsy and Clinical Diagnosis. Highlights in Biomedical, Environmental and Cardiopulmonary Research Day. March 19, 2019. Health Sciences Building. Abstract pg. 6
- Rafid-Hamed Z, Saxena A, **Kalra J.** 2019. Enhancing Quality in Health Care Through Medical Error Disclosure. Highlights in Biomedical, Environmental and Cardiopulmonary Research Day. March 19, 2019. Health Sciences Building. Abstract pg. 5
- Rafid-Hamed Z, **Kalra J.** 2019. Best Practice Model for Medical Error Disclosure – A Call for a Paradigm Shift. Life and Health Sciences Research Expo. May 2, 2019. Health Sciences Building. Abstract pg. 62
- **Kalra J.,** Saxena A., Rostampour N., Vantomme E. 2018. Aging and Functional Changes in Polymorphonuclear Leukocytes. Human Factors in Aging: Bridging Science and Support Policies for Elderly. 2018 AHFE. International conference on Applied Human factors and

Ergonomics. Proceedings of the International Conferences on Human Factors in Aging and Gerontology. Orlando, Florida, USA

- **Kalra J.,** Nayar A., Nogier K., Kopargaonkar A. 2018. Quality Management in Healthcare: Assessment Tools in Clinical Diagnostic Laboratories. Advances in Human Factors and Ergonomics in Healthcare and Medical Devices. 2018 AHFE. Proceedings of the International Conference on Advances in Safety Management and Human Factors. Orlando, Florida, USA
- Kopargaonkar A, **Kalra J.** 2018 A Quest for Quality Improvement in healthcare: A six sigma approach. 2018 Proceedings of the Annual Conference of the Canadian Society of Clinical Chemists (CSCC). Abstract
- **Kalra J.** Medical Error and Disclosure in Quality Care and Patient Safety: An Overview. Indian Journal of Clin Bio. 2017, Vol 32, Abstract IL 19, page S18.
- Vantomme E, **Kalra J**. 2018 Scanning the medical error discloser landscape – A global perspective. 2018, Canadian Journal of General Internal Medicine. Vol 13, no 1 research abstract
- **Kalra J.** Medical Error and Disclosure in Quality Care and Patient Safety: An Overview. December 2017, ACBICON 44th National Conference of Association of Clinical Biochemists of India, King George's Medical University, Dec 04, 2017 Lucknow, India.
(Symposium – Quality assurance in clinical laboratory)
- **Kalra J**, Kopargaonkar A.2017 Quality care and Patient safety; Strategies to disclose medical errors. Human Performance in healthcare and medicine. 2017 AHFE. 8th International conference on Applied Human factors and Ergonomics. Proceedings of the International Conferences on Human Factors and Ergonomics in Healthcare and Medical Devices. Los Angeles, California, USA
- **Kalra J,** Kopargaonkar A**.** Quality care and Patient safety; Strategies to disclose medical errors. Human Performance in healthcare and medicine. July 19, 2017. 2017 AHFE 8th International conference on Applied Human factors and Ergonomics.
- Kopargaonkar A., **Kalra J. 2017.** Scanning the Medical Error Disclosure Landscape- A Global Perspective. Proceedings of "Highlights in Biomedical, Environmental and Cardiopulmonary Research", Research Day, College of Medicine, University of Saskatchewan.
- Madampage C., Kopargaonkar A., **Kalra J. 2017.** A Quest for Quality Improvement in Healthcare: A Six Sigma approach. Proceedings of "Highlights in Biomedical, Environmental and Cardiopulmonary Research", Research Day, College of Medicine, University of Saskatchewan.
- **Kalra J.,** Kopargaonkar A**. 2016.** A Quality Perspective on Disclosure of Medical Error. Proceedings of Annual Conference of the Canadian Society of Clinical Chemists (CSCC). Abstract # 4 P103
- **Kalra J. 2016.** Quality care and patient Safety: Global approaches to Medical Error Disclosure. Proceedings of Annual Congress & Medicare Expo on Primary Healthcare. Vol. 06 (1), P28.
- **Kalra J. 2015.** Global Approaches to Medical Error Disclosure; A Quality Perspective in Diagnostic laboratory Services. Indian J Clin Biochem. Vol. 30 (1) S7, Abstract # S12.
- **Kalra J**. **2015.** Importance of Medical Error Disclosure: A comparative study between Health Regions. Proceedings of Canadian Laboratory Medicine Congress (CLMC), CLMC Online Library 101121. P302.

v) Invited Lectures Outside U Of S And Invited Conference Presentations… I have participated in various national and international conferences.

- **Kalra J.** 2019. Speaker for Plenary Session**,** Trends in Medical Error Disclosure and its

Implications – A Global View. 8th Annual Meeting of Indian Academy of Biomedical Science & Conference on Deliberation on Translation of Basic Scientific Insight into Affordable Healthcare Products. National Institute for Interdisciplinary Science & Technology. Thiruvananthapuram, Kerala, India. February 25, 2019

- **Kalra J.** 2018 Competency Based Curriculum for Residents. All India Institute of Medical Sciences, July 10, 2018, New Delhi, India
- **Kalra J.** 2018 Quality Management of Lab Protocols & Quality Management of Pre-analytical errors. Outpatient Clinic. All India Institute of Medical Sciences, July 10, 2018, New Delhi, India
- **Kalra J.** 2018**.** "Setting the stage", Indigenous Health: The Mysteries and Myths of the HIV Crisis in Saskatchewan. May 04, 2018.Saskatoon, SK.
- **Kalra J.** 2018. "Medical Error Disclosure: An Integral part of quality care and patient safety", Annual Conference of the Canadian Society of Clinical Chemists (CSCC). "Lightning talks", June 3-6, 2018, Ottawa, Ontario, Canada.
- **Kalra J.** 2017. "Quality Management in Healthcare: Assessment tools in Clinical Diagnostic Laboratories", American Society for Quality (ASQ) Canada Conference, "A Confederation of Quality Professionals Working toward an Inclusive and Sustainable Canada", Sep 25-26, 2017, Canada War Museum, Ottawa, Ontario, Canada.
- **Kalra J**. "Medical error disclosure policies: Mandate to preserve autonomy and reduce medical errors". Western Canadian Universities. Big Data Health Conference "The future of precision health and Big data", Sep 28-29, 2017, Banff Center for Arts and Creativity, Banff, Alberta, Canada.
- **Kalra J.** Medical Error and Disclosure. All India Institute of Medical Sciences, December 11, 2017, New Delhi, India
- **Kalra J.** A Global View of Medical Error. Lady Harding Medical College, December 14, 2017, New Delhi, India
- Fairbairn B., **Kalra J.** Engaging Faculty for Top Notch Planning, Society for College and University Planning (SCUP) Annual International Conference, July 10, 2017, Marriott, Washington DC
- **Kalra J,** Kopargaonkar A. Quality care and Patient safety; Strategies to disclose medical errors. Human Performance in healthcare and medicine. July 19, 2017. 2017 AHFE 8th International conference on Applied Human factors and Ergonomics.
- **Kalra J.** Medical Error and Disclosure in Quality Care and Patient Safety: An Overview. December 2017, ACBICON 44th National Conference of Association of Clinical Biochemists of India, King George's Medical University, Dec 04, 2017 Lucknow, India.
- **Kalra J.** 2017. "A laboratory Physician approach to Clinical cases". Saskatchewan society of clinical chemist- Saskatchewan Disease Control Laboratory, Regina, SK May 17, 2017.
- **Kalra J.** 2016. "Interesting clinical Cases", Saskatchewan Society of Clinical Chemist. Regina, Saskatchewan. October 26, 2016.
- **Kalra J.** 2016. "Quality Management and Assessment: Medical Error and Disclosure in Health Care and Laboratory Medicine -A Global view". Keynote speaker, Ross University Research Day, Ross University, Dominica. September 15, 2016.
- **Kalra J.** 2016. "Nuts and Bolts in research activities". Speaker, Ross University Research Interest Group, Ross University, Dominica. September 16, 2016.
- **Kalra J.** 2016. "Humanities and Ethical issues in Professional Activities". Speaker – Open Discussion, Ross University Interest Group, Ross University, Dominica. September 17, 2016.
- **Kalra J.** 2016. Guest Lecture for exchange students from National Institute of Food Technology Entrepreneurship and Management (NIFTEM), University of Saskatchewan, SK. July 26, 2016

- **Kalra J.** 2016**.** Quality Care Patient Safety: Global Approaches to Medical Error and Disclosure. Keynote speaker, Annual Congress and Medicare Expo on Primary Healthcare, Dubai, UAE. April 25-27, 2016
- **Kalra J.** 2015. Global Approaches to Medical Error Disclosure: A Quality Perspective in Diagnostic laboratory Services. Speaker, Symposium 03. 42nd National Conference of Association of Clinical Biochemist of India (ACBICON 2015), PGIMER Chandigarh, India. November 26, 2015.
- **Kalra J.** 2015. Integration of Laboratory Sciences. All India Institute of Medical Sciences (AIIMS) New Delhi, India. December 8, 2015.
- **Kalra J.** 2015. Interaction with Faculty and Residents on Research in Laboratory Medicine. All India Institute of Medical Sciences (AIIMS) New Delhi, India. December 7, 2015.
- **Kalra J.** 2015. Quality Care and Patient safety, Department of Pathology. Govt. Medical College, All Faculty members, Registrars, Medical Officers and Post Graduate Students. Jammu, India. November, 2015
- **Kalra J.** 2015**.** How to prepare for success, Chief Guest, "Parichay 2015", India Students Association, University of Saskatchewan, Saskatoon, SK, Canada, November 1, 2015.

4. Administrative Work and Activity

Involvement includes various administrative duties at a

Departmental
- Coordinator, Undergraduate Teaching Program Committee, Department of Pathology,
- Member, Endowment / Trust Funds Committee

College
- Member and Dean's Designate, College review Committee
- Chair, Nominations Committee, Faculty Council
- Member, Bylaws Committee, College of Medicine
- Member, Faculty Council, College of Medicine)

University level
- Member (Elected) Board of Governors, University of Saskatchewan
- Member- Executive Committee; College of Graduate and Postdoctoral Studies
- Member -at-Large, College of Graduate and Postdoctoral Studies Council
- Member Elected, at Large, University Council, University of Saskatchewan)
- Dean's Designate, Chair, Examining committee for PhD students.

PROFESSIONAL AND ASSOCIATION OFFICES AND COMMITTEE ACTIVITY OUTSIDE UNIVERSITY

I have been involved in various professional association and committee work outside the University of Saskatchewan including:
- Member, Board of Governors/Directors, Council of Canadian Academies (CCA),
- Chair, Audit Finance and Risk Committee, Council of Canadian Academies,
- Lead, Canadian Association of Health Sciences (CAHS) Regional Network,
- Vice-Chair, American Society for Quality (ASQ), Saskatchewan Section,
- Vice-President, Saskatchewan Society of Clinical Chemist (SSCC),

- Chair, Second International Conference on Human Factors in Aging and Gerontology (HFAGE) – conference track, Applied Human Factors and Ergonomics (AHFE), USA,
- Member, Human Factors and Ergonomics in Healthcare Scientific Advisory Board, Applied Human Factors and Ergonomics (AHFE), USA.

In addition, I have been involved with several international institutions to create a memorandum of understanding (MOU) for collaboration between our department and other institutions to cover research collaboration, and student/faculty exchange programs.

PUBLIC AND COMMUNITY CONTRIBUTIONS - NON-UNIVERSITY RELATED

I have been involved in many public and community associations. Some of them are as follows:
- Chair, 40th Anniversary, Saskatoon Folkfest,
- President, Saskatoon Folk fest Inc.,
- President, EMCY (Enriching my Canada and Yours) Awards Foundation,
- Vice-President, Community Services, Canadian Eyesight Global

HONOURS (MEDALS, FELLOWSHIPS, PRIZES)

My work has received notable recognition in various areas.

- Nominee, Undergraduate Student Teaching Award, University of Saskatchewan. University of Saskatchewan Student Union (USSU), 2018-19.
- Recipient, “Leadership and Lifetime Contribution to Quality” Award, American Society for Quality (ASQ) – Saskatchewan Division, May 8, 2019
- *(Comments: Recognized for outstanding Leadership and Lifetime contributions to Quality for ASQ – Saskatchewan Division).*
- Recipient, Markewich D, Kalra J: Poster Award, Undergraduate Category – 2nd Floor Research Day Poster Competition. College of Medicine, Health Science Building. University of Saskatchewan. March 19, 2019.
- Rafid-Hamed Z, Kalra J. 2019 Improving Quality Care and Patient Safety – A Call for Transparency in Medical Error Disclosure. ASQ Studentship Award. May 8, 2019.
- Recipient, Markewich D, Kalra J: “An Assessment of Discordance between Autopsy and Clinical Diagnoses” 1st Place – Quality Improvement at Fall Poster Day 2018. College of Medicine, Health Science Building. University of Saskatchewan. November 15, 2018.
- Recipient, 10 University of Saskatchewan (U of S) 150 Citizen, University of Saskatchewan, September, 2017.
- Recipient, Saskatoon – Grasswood Canada 150 award. City of Saskatoon, August 2017.
- Recipient, Best Poster Award (Kopargaonkar A., Kalra J.), “Scanning the Medical Error Disclosure Landscape- A Global Perspective”. Highlights in Biomedical, Environmental and Cardiopulmonary Research, Research Day, College of Medicine, University of Saskatchewan, March, 2017.
- Recipient, Outstanding Service Recognition, Recognized for five (5) years of service as council Chair, University Council, University of Saskatchewan, November, 2016.
- Recipient, Canadian Society of Clinical Chemists (CSCC) Award for Outstanding contributions to Clinical Chemistry for 2016, Joint Conference of the CSCC and Canadian College of Medical Geneticists (CCMG), Edmonton, July, 2016.

- Recipient, Peter C. Dooley Legacy Award, recognized as champion of collegial governance and collegial decision-making at the, University of Saskatchewan Faculty Association (USFA), University of Saskatchewan April 7, 2016
- Recipient, CTV, 2015 Saskatoon Citizen of the Year Award, March 18, 2016
- 2015 Employee Service Recognition, Recognized for reaching thirty (30) years of service milestones. Employee Service recognition Gala, Saskatoon Health Region, November, 2015.
- Recipient, Outstanding Community Service Award, 34th annual Alumni Tribute Awards, Memorial university of Newfoundland, October 19, 2015
- "60 Influential Canadians over 60". Recognized in a Senior Living blog, A Place for Mom chose 60 extraordinary Canadians over 60 who are esteemed for their contributions to society, August, 2015
- Recipient, "2015 Paul Yuzyk Award for Multiculturalism-Lifetime Achievement". Selected by Ministry of Citizenship, Immigration and Multiculturalism, Govt. Of Canada, Toronto, August, 2015
- "Kalra Street", Aspen Ridge, University Heights. Named by the City of Saskatoon, July 2015.
- Recipient, "American Society for Quality (ASQ) Leadership Award", in recognition for Commitment and Outstanding Contribution to ASQ-Saskatchewan and Community, May 2015

Dr. Marilyn Kinloch
MAR 2020

COURSES TAUGHT

Undergraduate Medical Education MEDC 226.19
Histology of the female reproductive system

COURSE DEVELOPMENT

2018/6 Post Graduate Medical Education
Course Director, Practical Workshop on Mismatch Repair Testing in Gynecologic and Gastrointestinal Cancers

20186 Post Graduate Medical Education
Co-Course Developer, Glandular Lesions in the Gynecologic Tract, Update for the Practicing Pathologist

STUDENT/POSTDOCTORAL SUPERVISION

BACHELOR's

2019/5-2019/9 (Principal Supervisor), Sebastian Leakos, U of S
Thesis/Project Title: Biting Off More than Expected: Unexpected Malignancies Diagnosed Following Hysteroscopic Intrauterine Morcellation

Dr. Fergall Magee

- UGME MEDC 115 Principles Course “Introduction to Laboratory Medicine”
- UGME 3rd YR Medical Review “Prenatal Screening”
- College of Pharmacy & Nutrition PHAR 298 Personalized Medicine “Genomics”
- Department of Medicine/Canadian Centre for Health & Safety in Agriculture “Review of Current and Future Advances in Genomic Diagnoses”

Dr. Erick McNair

TEACHING

*Briefly describe your teaching contribution to undergraduate medical educatio*n

My teaching contribution to undergraduate medical education is through lecturing to students enrolled in the Survey of Pathology (PATH 205) course. I provide the students with 80-minute lectures on the following topics: The Heart (Coronary Artery Disease & Myocardial Infarction, Valve Disease, Heart Failure); Blood (Anemia and Leukemia); and Hemodynamics (Edema, Thrombosis, Embolism, Shock). I am expected to acquire up 2 more lectures (Lung and Kidney) in the fall of 2020.

Briefly describe your teaching contribution to graduate medical education

My teaching contribution to graduate medical education is through lecturing to medical students on heart disease in Med 126 (Valve Disease and Heart Failure) and have also made several presentations to pathology residents on academic half days.
I also teach graduate students in the School of Physical Therapy in the course Pathology for Physical Therapists (PTH 805) where I provide a 140-minute lecture covering Altered Perfusion and altered Fluid and Electrolyte Balance. I have also mentored and supervised a graduate student and a Research Fellow In my pursuit of teaching excellence, I have attended a least once yearly courses and/ or workshops below:

Name of Workshop	**Sponsor**	**Year**
Teaching Boot camp: Prep for Teaching	COM	Feb, 2018
Teaching and Learning Tuesdays	COM	Feb, 2018
Teaching Boot camp Modules	COM	Dec 5-7, 2017
Developing a Reflective Teaching Portfolio	GMTL	Dec, 2016
Flipped Classroom I and II	GMTL	Jan 26 & 28, 2015
Learner Centered Assessment: Effective Feedback through	GMTL	Nov, 2014

Rubrics		
How Learning Works	COM	Nov, 2014

offered by the Gwenna Moss Center for Teaching Learning and College of Medicine Faculty Development and Teaching Seminars and Teaching Boot Camps. Attendance of these courses and workshops have produced improvement in my teaching as evidenced in my peer and student evaluations.

Briefly describe any other teaching contributions that you make to education including interdisciplinary teaching; i.e. technologist or other health professional

I have been provided yearly lectures to students in the College of Nursing (Maternal Child Nur 300 and 300.3). I provide lectures and created a Panopto lecture for the students on topics of cardiac hemodynamics and congenital cardiac anomalies. I have also spoken at Department of Pathology Grand Rounds on my research activities.

Dr. Ania Radomska
May 2016 – August 2018

I was appointed in the Department of Pathology and Laboratory Medicine College of Medicine University of Saskatchewan on 02 MAY 2016. The appointed position - Assistant Professor Academic Programming Appointment, Category 5 calls for a split of 85% teaching and 15% research.

The main duty allocation as advised by my head of department Dr. F. Magee called for the design, preparation and implementation of a new departmental course aimed at first year pathology resident teaching: “Foundation in Pathology: First Year Resident Course”.
The following document reports on my progress in our department over the period of last two years.

TEACHING

Foundation in Pathology: First Year Resident Course

1. Teaching philosophy underlying the creation of this course
I am an experienced academic and clinical pathologist with 38 years of practice. I worked with under and postgraduate students in Poland, UK, Canada, and Ireland. This international experience in learning and teaching pathology greatly assist me in the education of young pathology residents at the University of Saskatchewan in Saskatoon.
I have observed that pathology residents in Canada have different levels of education, knowledge and preparation for residency education in pathology. I want to optimize and standardize pathology training, to allow residents to meet individual needs and objectives. No program was ever been offered to first year pathology residents in this department. The course I created from the scratch (no educational materials were available in our department, no resources) is unique and a survey of the universities in Canada shows that McGill is the only institution to offer a similar course for first year residents (PGY1).

2. Course description
This is a 12-week course in three monthly instalments entitled “Foundation in Pathology” for first year pathology residents.
The course starts with:

- Safety rules and regulations in Histopathology Laboratory,
- Methods of tissue preservation and preparation, tissue grossing, cutting up, embedding, staining including IHC,
- The residents learn the use of light microscopy to view histology slides,
- They observe grossing and follow simple cases from accessioning to resulting slides and signing out a diagnostic report (2x a week from 9:00-12:00),
- After 2 months of observation they are asked to perform themselves at least 5 non-oncologic and 2 oncologic specimen (the goal for residents is to obtain both knowledge and the skills that will lead them to specific competency and finally be trusted to perform the key task of the discipline, EPA- Gross dissection),
- They are introduced to frozen section and observe the technologist in its preparation and learn its diagnostic values for the patients.

Residents learn histology of different tissues and organs and for this purpose I prepared 13 lectures with images and slide sessions after each lecture. Among them there is 9 lectures lasting 1h followed by 1h slide session each. There is 1 lecture with slide session that lasts altogether 1h and two 2h lectures followed by 1h slide session each. Therefore, there is 14h lecturing time and 12h histology slide sessions.
For general pathology review I prepared 10 seminars with images. Among them 6 seminars lasts 1h each. Two seminars last 2h each and one is 1.5 seminar. Therefore there are 11.5 h seminars with images. Each seminar is followed by test lasting 30min to 1h. I spend time also for preparation and printing these tests for their correction and explanation to the residents.

Residents also take slide histology examination, that consists of slide session viewing and slide description. They usually write short notes to describe slides for themselves and then they present slides to me describing it orally. I spend individual time with each of residents depending of their needs (See Resident Teaching Time table).

My total contact hours with 9 residents was 497 hours. For slide preparation I spent 840 hours.

Lectures with images

Histology lectures with images include the following topics:
1) Tissue concept and classification (slides: 41; 1h lecture followed by 1h slide session)
2) Connective tissue histology (31 slides; 1h lecture and 1h slide session)
3) Cartilage histology (11 slides, 30min lecture and 30min slide session)
4) Cardiovascular system histology (49 slides; 1.5h lecture and 1h slide session)
5) Skin histology (55 slides; 1h lecture and 1h slide session)
6) Gastrointestinal system histology (105 slides; 2h lecture and 1h slide session)
- Esophagus
- Stomach
- Small intestine

- Large intestine

7) Liver, gallbladder and Pancreas histology (66 slides, 1h lecture and 1h slide session)
8) Respiratory system histology (40 slides; 1h lecture and 1h slide session)
9) Urinary system histology (50 slides; 1h lecture and 1h slide session)
10) Female reproductive system histology (84 slides; 2h lecture and 1h slide session)
11) Breast histology (27 slides; 1h lecture and 30 min slide session)
12) Endocrine organs histology (30 slides; 1h lecture and 1h slide session)
13) Introduction to pathology: methods of tissue preservation and preparation (70 slides; 2h lecture with images)

General Pathology Review Seminars

1) Adaptive pathology (55 slides; 1h seminar and 30 min test)
2) Inflammation and repair (124 slides; 2h seminar and 1h test)
3) Hemostasis and thrombosis (82 slides; 1.5 h seminar and 30 min slides)
4) Genetic disorders (84 slides; 1.5 h seminar and 30min test)
5) Immune system disorders (51 slides; 1h seminar and 1 h test)
6) Neoplasia (60 slides; 1h seminar and 1h test)
7) Infectious diseases (40 slides; 1h seminar and 1h test)
8) Environmental pollution and diseases (92 slides; 1.5h seminar and 1h test)
9) Atherosclerosis and blood vessels disorders (68 slides; 1.5h seminar and 1h test)

Resident Teaching Time

From July 2016 until the end of July 2018 I taught 9 residents. Eight residents completed this course, and ninth resident is in progress. The 10th resident is coming to my program on December 17, 2018.

Table 1 below shows my time spent on seminars, presentations, slide sessions, test and slides and lecture/seminars preparation.

I spent different amount of time with each resident according to their personal needs.

Table 1. Resident teaching time.

Resident	Seminars/presentations (h)	Slide Sessions (h)	Test (h)	Direct teaching time (h)	Evaluation Time (h)
Resident 1	20.5	40.5	8	69	2
Resident 2	23.25	20	7	50.25	4.5
Resident 3	19.5	3.0	1.5	24	2
Resident 4	22	17	5.5	44.5	4.5
Resident 5	36	25	9.5	70.5	5
Resident 6	32	44.5	12	88.5	2.5
Resident 7	29	12	7	48	3.0
Resident 8	26	13	7.5	46.5	2.5

Resident 9 in progres	16.5	4	7.5	27	1
TOTAL	**224.5**	**179**	**65.5**	**468**	**29.0**
Total contact hours	**497.0**				
Teacher preparation time	**1287 slides (840 hours)**				

Total contact hours spent with residents: 497h
Total time for slides preparation (lectures/seminars): 840h

Preceptor Evaluations by Residents

Lecture	Average Resident Score (1 lowest- 5 highest)	N
Tissue fixation and preparation	4.2	3
Cell Biology and Histology	5.0	2
Tissue Concept	5.0	3
Skin Histology and Slide Session	4.6	4
Adaptive Pathology	4	1
GIT Histology and Slide Session	4.25	2
Liver, Pancreas, Gallbladder and Slide Session	4.5	4
CVS Histology and Slide Session	3.95	2
Female Reproductive System and Slide Session	4.7	3
Breast Histology and Slide Session	4.0	2
Urinary System Histology and Slide Session	4,7	4
Respiratory System and Slide Session	Not tested	
Connective Tissue Histology and Slide Session	5.0	2
Endocrine Organs histology	Not tested	
All Sessions Average Score	**4.5**	

RESEARCH AND SCHOLARLY WORK

I engaged in a collaborative research work with colleagues from my department and RUH– Dr. R. Chibbar and Dr. A. Agrawal and a first year medical student, Mr. D. Lee. This is a quality assurance project focusing on gastric-type endocervical adenocarcinoma. The findings of this study will be presented at the 2018 College of Medicine Dean's Summer Research Fall Poster Day on the 23 November 2018 (please see the abstract below). The project was designed during discussions with my colleagues. First we wrote the grant proposal and obtained ethics committee approval. Than we obtained a list of all cervical biopsies, hysterectomy and trachelectomy specimens diagnosed in City Hospital and RUH from 01of January 2000 until the end of December 2015. I went through all diagnostic reports of the patients and selected only cases diagnosed as endocervical adenocarcinoma (ECA). I found 40 cases. We pulled out all the slides from these 40 cases from two hospitals. I checked all clinical histories of these patients including their follow up from the date of first diagnostic biopsy, performed hysterectomy as a treatment and further cytology checking on progression of the disease. I viewed over 500 slides by microscopy to choose only one -two best slide/slides of a case as representative for immunohistochemistry. All this work I have done before Mr. D. Lee joined this project in the middle of May 2018.
I worked and supervised Mr. Lee during his summer term. In particular, I introduced him to physiology and pathology of female reproductive system and taught him concepts of histology and histopathology focusing on neoplasia of female reproductive tract. We regularly discussed the progress and findings of our study.

FUTURE PLANS

1. Presentation of research project on *A retrospective study of the prevalence of gastric-type endocervical adenocarcinoma in the Saskatoon Population* on Department of Surgery and Pathology Research Day in May 2019
2. Poster will be presented on Fall Research Day 23rd of November 2018
3. Presentation of course design and outcome analysis to ICRE- abstracts and publication
4. I would like to set up a new research project with one of the residents on "the exosomes as new biomarkers in breast cancer"
5. Extension of curriculum

a. Preparation of a pool of human tissues and organs histology slides for Resident's teaching

b. Post-mortem techniques with provisional diagnosis and sections of different organs for histology and final histopathological diagnosis: post-mortem VR capability.

Dr. Rajendra K. Sharma

TEACHING ACTIVITIES

Graduate Course Coordinator – PATH 898.3 – Signal Transduction
(Instructor: **Dr. RK Sharma**)
Unscheduled Instructional Activity
Total teaching hours (2018 – 2019): Total hours 43

Total teaching hours (2017 – 2018): Total hours 35
Total teaching hours (2016 – 2017): Total hours 33
Total teaching hours (2015 – 2016): Total hours 54

SUPERVISION AND ADVISORY ACTIVITIES
Medical Summer Students Supervised:
Mr. Joel Howlett
Graduate Student Supervision:
Mr. Praveen Kumar Roayapalley, PhD Student; Ms. Sukanya Pati, MSc Student
Graduate Theses Supervised:
Ms. Kinjal Lakhani, Student
Post-doctoral Supervision:
Dr. Swagatika Das, Dr. Sujeet Kumar and Dr. Sreejit Parameswaran
Research Officer:
Dr. Sreejit P Nair

BOOKS AND CHAPTERS IN BOOKS
Sharma RK, Das U, Parameswaran S, Kumar S, Dimmock JR (2017) Calpain Activity and Expression in Human Colonic Tumors. Pathophysiological Aspects of Proteases. (Chakraborty S, Dhalla NS eds) Springer Publisher, pp 161-170

Kumar S, Das U, Dimmock J, **Sharma RK** (2017) Role of Proteases in the Regulation of N-myristoyltransferase. Proteases in Physiology and Pathology. (Chakraborty S, Dhalla NS eds) Springer Publisher, pp 89-99

PAPERS IN REFEREED JOURNALS

My personal public Link to Google Scholar is:
https://scholar.google.ca/citations?hl=en&user=R2syoXsAAAAJ

Citation indices	*Since 2015*
Citations	*2292*
h-index	*22*
i10-index	*70*

Nair SP, **Sharma RK** (2020) Heat shock proteins and their expression in primary murine cardiac cell populations during ischemia and reperfusion. Mol Cell Biochem **464**, 21-26

Sreejit Nair, **Sharma RK** (2019) Effect of ischemia and reperfusion on Ca^{2+} and calmodulin-regulated proteins in primary murine cardiac non-myocytes. J Mol Biol Ther **1**, 72-79

Sreejit Nair, **Sharma RK** (2019) The relevance of cardiac fibroblasts in ischemic heart disease. J Mol Biol Ther **1**, 56-64

Sharma RK (2019) Ca^{2+} /Calmodulin-dependent Cyclic Nucleotide Phosphodiesterase (PDE1): 40 Years Journey. J Mol Biol Ther **1**, 24-44

Sharma RK (2019) Protein N-Myristoyltransferase: A potential biomarker for colon cancer. J Mol Biol Ther **1**, 4-5

Das U, **Sharma RK,** Dimmock JR (2018) Enhanced chemosensitivity of tumours to antineoplastic agents. J Drug Discov Dev Res **1**, 38-49

Sharma RK, Das U, Kumar S, Dimmock JR (2018) Protein N-myristoyltransferase: 30 Years Journey. J Drug Discov Dev Res **1**, 7-38

Sharma RK, Parameswaran S (2018) Calmodulin-Binding Proteins: A Journey of 40 Years. Cell Calcium **75**, 89-100

Das U, Howlett J, Kumar S, Parameswaran S, Sharma A, Dimmock JR, **Sharma RK** (2018) NMT (N-myristoyltransferase). Encyclopaedia of Signalling Molecules **2**, 3522-3533

Parameswaran S, **Sharma RK** (2016) Insulin cannot induce adipogenic differentiation in primary cardiac cultures. Int J Angiol **25,** 181-185

Parameswaran S, **Sharma RK** (2015) Expression of calcineurin, calpastation and heat shock proteins during ischemia and reperfusion. Biochem Biophys Reports **4,** 207-214

Kumar S, Parameswaran S, **Sharma RK** (2015) Novel myristoylation of the sperm specific hexokinase 1 isoform regulates its atypical localization. Biol Open. **4,** 1679-1687

Kumar S, **Sharma RK** (2015) N-Terminal region of the catalytic domain of human N-myristoyltransferase 1 acts as an inhibitory module. PLOS One DOI: 10.1371/journal.pone.0127661

Parameswaran S, Kahlil M, Ahmed KS, **Sharma, RK**, Xiang J (2015) Enhanced protective immunity derived from dendritic cells with phagocytosis of CD40 ligand transgene-engineered apoptotic tumor cells via increased dendritic cell maturation. Tumori J **101**, 637-643; DOI:10.5301/tj.5000297

Abstracts:
Kumar S, Parameswaran P, **Sharma RK** (2015) The N-terminal atypical region regulates non-mitochondrial localization of novel hexokinase isoform. Experimental Biology. Abstract # 728.35

PRESENTATIONS:

Oral Presentations:
Research Day, Department of Pathology & Laboratory Medicine, College of Medicine, University of Saskatchewan, Saskatoon, SK, Canada, November 26, **2019**

Poster Presentations:
USask Synchrotron Sciences Poster Symposium. (presented by Graduate Student).Saskatoon, SK, Canada. **2019**

Three Rs & Animal Research Symposium. (presented by Graduate Student). Saskatoon, SK, Canada. **2019**

Annual Meeting of Experimental Biology, Boston, MA, USA. **2015**

American Association for Cancer Research-International Conference on New Horizons in Cancer Research: Biology to Prevention to Therapy. New Delhi, India. **2011**

RESEARCH FUNDING:

University of Saskatchewan, Department of Surgery, CoM **$15,000**
"Droplet PCR analysis of human papilloma virus in head and neck cancers"
Co-investigator – Dr. R K Sharma

University of Saskatchewan, Department of Surgery, CoM **$15,000**
"Generating head and neck cancer cell lines for studying HPV associated HNSCC"
Co-investigator – Dr. R K Sharma

Canadian Breast Cancer Foundation **$261,000**
"Role of N-Myristoyltransferase in modulating breast cancer".
Principal Investigator: Dr. R.K. Sharma

Heart and Stroke Foundation of Canada **$170,000**
"Calmodulin regulated protein in Heart"
Principal Investigator: Dr. R.K. Sharma

Summer Student (Studentship from the College of Medicine, University of Saskatchewan)

Mr. Joel Howlett **$ 9,000**
(Supervisor, Dr. R.K. Sharma)

Editorial Board

Editor-in-Chief: Journal of Molecular Biology and Therapeutics
Website: www.innovapublications.com
Molecular Cellular Biochemistry; World Journal of Immunology, Frontiers in Cellular Biochemistry

International Scientific Visits:

Dr. A. Chhikara, Professor, University of Delhi, Delhi, India –On sabbatical leave. July 2018-present

Section 5 – Research Mandate

Section 5 – Research mandate

a) Briefly describe how the department's research agenda aligns with its strategic plan and strategic priorities.

As discussed in Sectio-2-Alignment with College's Strategic plan Research in the Department aligns with the Vision, Mission and Values of SHA and the COM.

Pathology and Laboratory Medicine (PALM) is the 'science behind the cure'- up to 70% of medical decisions are based on some form of PALM result. While PALM has a long history of successful research traditionally this has been limited to an academic minority working in a somewhat' isolated milieu'. Our Department has some highly successful researchers with CIHR success but in the process of a recent Departmental retreat we have recognized the need to promote involvement of many other departmental members in research initiatives. Today our Department stands on a number of cusps-structural-the transition to a provincial laboratory system is underway and gaining speed, educational-Competence by Design was introduced to our residency program in JUL 2019 and technological-a genomic revolution is under way in all of our diagnostic Laboratories. Our Department should begin to leverage the potential for research opportunities provided by these changes and honor the vision (to become leaders in improving the health and well-being of the people of Saskatchewan and the world) and mission (to improve health through innovative and interdisciplinary research and education) of the COM. Potential exists for improved health outcomes for the patients of Saskatchewan from initiatives as diverse as greater leverage of 'Point of Care' technology and telemedicine, engagement with indigenous communities around implementation of genomic and serologic testing for infectious disease, educational projects around enhanced test utilization by primary care providers, or more detailed outbreak analysis and enhance knowledge translation by fostering a culture of multidisciplinary and distributed inquiry.

The COM Strategic Plan 2017-2022 (Appendix-2) lists the following Strategic Directions:

Strengthen research capacity - *leverage expertise and opportunities while performing research across the breath of biomedical sciences, clinical medicine, health systems and health populations to create an environment where research can excel.*

Social Accountability and community engagement - *Address the priority health concerns of the communities the college is mandated to serve, incorporating authentic community engagement and mutually beneficial partnerships. Focus on equity and community engagement by interweaving social accountability throughout the college's operations.*

Indigenous Health - *respond to the calls for action in the truth and reconciliation Report and work in a mutually beneficial and collaborative manner with the Indigenous peoples of Saskatchewan to define and address the present and emerging health needs in indigenous communities*

Provincial Laboratory Medicine promotes three equally important mandates - Clinical Care, Public Health and the Academic mandate. Traditionally, the department has basic science research (undertaken mainly-but not exclusively by faculty who work in Health Sciences). However, given that the department now comprises faculty who possess skills in the areas of Public Health, Infectious

Disease, Chemistry, Hematopathology, Transfusion Medicine, Anatomic Pathology, Genomics, Tissue transplantation, Immunodiagnostics, Health economics and utilization, Informatics, Education and Educational scholarship and Health system design, members of the Department are beginning to engage in multiple, multidisciplinary and distributed initiatives.

A short list of some on-going Department initiatives that align with the COM strategic plan include engagement with the Saskatchewan Cancer Agency (Cancer cluster), Child and Women's Health (gynecological and pediatric cancer) Western Canada Veterinary College (One Health), School of Pharmacy (Pharmacogenomics), varying educational groups (Sask. Polytech, COM, Luxonic-VR as an educational tool), diagnostics metrics in transgendered populations, Public Health (implementation of genomic diagnostics in rural and remote locations), newborn screening customized to our Indigenous populations (SCID), enhanced diagnosis of renal failure (IgA) and organ rejection, implementation of Liquid Based Cytology and HPV Self-testing, digital imaging technology initiatives with rural locations in the areas of anatomic and hematopathology, utilization and appropriateness studies, Choosing Wisely Conferences 2018, 2019 (in association with the Department of CME).

These collaborations align with the COM Strategic Plan and reflect the sentiments expressed in the TOR of our Departmental Research Funding initiative. (Appendix-2). Continued access to Departmental Funds, recruitment of an embedded PhD Coordinator and an Informatics Scientist would significantly empower these initiatives

b) Briefly comment on whether the department is meeting its self-identified research productivity goals.

The Department has a successful track record for research productivity. The USFA component of the Department provides 5.37 FTEs dedicated to research, and 0.75 FTE to educational scholarship (academic programming appointment). This group comprises a Cancer Cluster, while additional individuals focus on Biochemical mechanisms of signal transduction, acute renal disease, patient safety and health systems, educational scholarship and mechanisms of cancer development. However there is also significant research from "clinical faculty" whose areas of interest include biomarkers in diseases (including COVID-19), microbial susceptibility and anti-biotic resistance, disease mechanisms in neuropathological diseases, innovative technologies in chemistry diagnostics, applications for tandem mass spectrometry, advanced diagnostics in electrophoresis, varying applications of next generation sequencing in areas other than cancer, early diagnosis of organ rejection, and outbreak analysis and response.

Over the past five years faculty, residents and staff have authored or coauthored over 100 papers and abstracts, 7 chapters and 2 books, and have secured in excess of $6 million dollars in funding as Principle Investigators, Co-Investigators and Co-Applicants. We are proud to celebrate their achievements and would like to continue to increase departmental research productivity.

c) Provide examples of departmental research initiatives that support socially accountable objectives and indigenous health priorities, as identified by the department, the college, the university and the health authority.

1. Liquid Based Cytology (LBC) Implementation of LBC and HPV self-testing leading to enhanced diagnosis of earlier cervical cancer in marginalized populations (Funding secured from MOH, RFP closed-implementation imminent-subject to COVD Pandemic)

2. Customized newborn screening panels of Indigenous populations
Severe Combined Immune Deficiency has a national incidence of 1 in 78000 livebirths –but displays a higher incidence in Northern Cree and Mennonite populations (1 in 27,000)-proposal submitted to MOH August 2019)

3. Personalized ranges for Transgendered Individuals (currently in progress)

4. Epidemiology studies on Ig A Nephropathy in Indigenous populations (funded by Department Research Fun- and underway)

5. Genetic signature and predisposition to transplant organ failure by utilization of **NanoString** technology-SPH Foundation in process of securing funding through Hospital Home Lotto

6. Implementation of **GenXpert** to 19 rural and remote locations to facilitate earlier diagnosis of COVID-19 infection-deployment complete-(this platform can be pivoted to TB, HepC and HIV diagnostics post COVID-19 Pandemic).

Please see list of initiatives discussed in **Section 2** under headings **"Social Accountability and Community Engagement"** and **"Indigenous Health**".

d) Provide examples of original departmental research, analysis or other scholarly activity that have resulted in innovations or advances in clinical care.

1. The promotion of a **'quality culture'** and introduction of a Quality Management system.'

2. The implementation a **'tissue tracking'** system in Anatomic Pathology.

3. The on-going **patriation and expansion of "companion diagnostics**" (genomic interrogation of malignant tumors to determine optimal treatment) provides greater access, with significantly shorter turn-around times for patients of the Saskatchewan Cancer Agency (please see also report from Dr. Mary Kinloch, Division Head, Anatomic Pathology and Co-Leader for Provincial Anatomic Pathology Discipline Specific Group and report from Dr. John DeCoteau in Section 3-Patient Care Mandate).

4. The implementation of **Rapid Aneuploidy Diagnosis (RAD**) to provide parents with access to timely diagnosis of aneuploidy (Trisomy 21, 18, etc.).

5. The implementation of the **Prevention of Alloimmunization in Mothers of Saskatchewan (PRAMS)** – repatriating all provincial prenatal transfusion testing from Canadian Blood Services in Vancouver to Regina, Prince Albert and Saskatoon (please also refer to the Transfusion Medicine report from Dr. Sheila Rutledge Harding).

6. Two division members in Anatomic Pathology have taken **the Clinical Quality Improvement Program (CQIP)**, as referred to in a number of previous sections-departmental access to a Research Support Individual would enhance many areas of departmental research provided by the Saskatchewan Medical Association and Health Quality Council. The role of CQIP is to promote physician leadership in continual quality improvement. One pathologist developed subspecialty metrics of the breast service.

The success out of this project improved turnaround times, communication in the lab and moved to a pull system for case **distribution instead of a push system.**

7. **CQIP-continued-**A second division member performed a study around DNA extraction utility and turnaround time. This resulted in improved extraction rates (67% to 1005) a turnaround time improvement from 4 weeks to less than 8 days. The cytology team has developed a pathway to **validate biomarker testing on cytology specimens**-until this initiative not considered suitable for biomarker assessment. The success of this study has promoted in the implementation of a safer, less invasive procedure resulting in improved patient care.

8. Implementation of universal testing for **mismatch repair** in cases of colorectal, endometrial and ovarian for hereditary cancer detection. This reduces the burden on medical genetics, shortens wait times and most importantly proactively identifies patients and their families who may require high risk surveillance or testing.

9. Implementation of molecular diagnostics national in the diagnostic pathway of patients who develop gynecological malignancy (Dr Mary Kinloch).

10. The development and implementation of national rigorous quality assurance methodologies in the areas of immunohistochemistry and biomarker utilization (Dr. Emina Torlacovic).

11. More robust identification of disease types, therapeutic implications in terms of drug type and treatment duration and earlier recurrence of hematopathologic malignancies (Dr. John DeCoteau-please see also contribution in Section 3).

12. Transfusion Medicine(TM)

a. Dr. Oksana Prokopchuk-Gauk is the current Chair of the National Advisory Committee (NAC) on Blood and Blood Products, and has co-authored some of their recommendation documents.

b. Dr. Sheila Rutledge Harding chaired the Interprovincial Medical Expert Committee in 2017-2018 that developed and published *Criteria for the clinical use of immune globulin* for implementation in Alberta, Manitoba and Saskatchewan. Order sets for appropriate administration of IVIG have also been developed and implemented.

c. Participation in the Canadian START (Screening by Technologists and Auditing to Reduce Transfusions) Study significantly improved appropriateness of red blood cell transfusions and the use of single-unit transfusions in Saskatoon and Regina.

d. Provincial recommendations for best practice in various aspects of Transfusion Medicine, pediatric and adult, have been developed and disseminated.

e) <u>Describe departmental participation in original evidence-based research, analysis, planning or other scholarly activity that has led to quality improvement in clinical programming or the delivery of clinical care</u>.

1. Introduction of Non-Fasting Lipid Testing (Drs. A. Lyon and F. Wu).

2. Critical appraisal of 3S of RFP for glucometers for the entire province-with safer alternatives proposed for Pediatric Care (Dr. Martha Lyon).

3. Please refer to discussion on TM in previous section.

4. Microbiology

a. Established and elevated the important role of Public Health and worked collaboratively to establish a virtual program, such that all clinical staff in the province are taking a leadership role in in key areas of expertise.
b. Through collaboration with the Infection Prevention and Control (IPAC) team and laboratory, Extended Spectrum Beta Lacatamase (ESBL) screening has been discontinued and Carbapenemase Producing Organisms (CPO) screening is now performed in Saskatoon and Regina.
c. Standardization of one provincial Microbiology requisition is in progress.
d. Request for Proposals (RFP) in progress to ensure standardization of equipment and processes.
e. Implementation of "position statements" as a means of communication to all Microbiology laboratories and stakeholders in order to provide a concise process to communicate changes and updates the committee has made.
f. Deployment of genomic testing for infectious disease in rural and remote locations (GeneXpert).

Also the full list of initiatives discussed in **Section 5 c, 5,d** and in **Section 3, c**-and report in **Section 3** from Dr. John DeCoteau and ADRL.

f) Describe departmental participation in original evidence-based research, analysis, planning or other scholarly activity that has led to improvements or innovations in medical education.

1. Please see contribution from Dr. Benoit in **Section 4** and documentation of CBD roll-out provided in Appendix 4.
2. Please see contribution of Histology module development provided by Dr. A. Radomska in in Section 4.

3. Currently an initiative is under way with **Luxonic** (commercial vendor) to develop Virtual Reality modules devoted to Surgical Pathology for our residents and Masters students rotating through Saskatchewan as part of the University of Calgary Master Pathology Assistant Program (JF Magee, Anurag Saxena, Mary Kinloch, Rhonda Hartz).

g) Briefly describe how the department provides mentorship for new researchers.

Faculty and residency research is supported within the department with distribution of endowment and discretionary research funding on many occasions-but the amounts are insufficient. The department does not have access to a dedicated clinical researcher coordinator and would benefit greatly from such a resource. The department, however, must acknowledge great support from the OVDR and currently three junior researchers are involved in a mentorship initiative, with the assistance of the OVDR and Dr. Marek Radomski. As noted earlier in this section, the department has engaged with and benefits tremendously from a number of multidisciplinary collaborations (Section 5, a]). Faculty members based in Regina (RRPL) have benefited from collaborative mentorship through the Public Health Agency of Canada and National Microbiology Laboratory.

h) Briefly describe departmental involvement in graduate student research supervision.

Members of the Department's Cancer Cluster are responsible for the educational oversight of 14 highly qualified individuals including three post doc fellows, three graduate students, two undergraduate students and one summer student. Please see individual reports at the end of this section from Drs. DeCoteau, Freywald, Geyer and Uppalapatti. And in addition, reports from

Drs. Sharma and McNair, and from faculty Involved in clinical service (Drs. Kalra and Kinloch-and when she returns from sabbatical-Dr. Kanthan).

i) Briefly describe how the department supports research undertaken by residents.

All of our residents are required to complete at least one research project during their residency training. This contributes to a culture of research in our department and advances scholarly activity. We aim to develop our residents as life-long learners, committed to an evidence informed practice, critical appraisal of literature, quality improvement and patient safety. Collaborative multidisciplinary projects are encouraged and distribution of 'discretionary' funding is weighted towards that which include resident, multidisciplinary, distributed and patient advocacy components.

Residents present their research annually at our Department Research Day-to colleagues and external guests. All presentations are scored and ranked by a selected panel of judges-prizes are presented to winning presentation (basic science, senior resident, junior resident and multidisciplinary sections). Residents are encouraged to present their work at national and international conferences-and to publish their findings-please see list of resident presentations and publications in Appendix 5.

To further prepare residents undertaking research, a module entitled 'Research Methods' to be delivered by one of the departments' senior researchers (Dr. Raj Sharma) had been scheduled for Spring 2020-unfortunately it has been delayed by the COVID-19 Pandemic.

j) Identify any obvious gaps in faculty expertise relating to specialty-specific research and steps taken to address these gaps.

One skill set that our department lacks is in the area of informatics-we are seeking funding to attract an informatics scientist to the department.

As much referred to in the next domain (k)-is that clinical demands and lack of sufficient clinical/academic faculty members results in a limited capacity to commit to 'protected' time and provides an on-going challenge to attempts to advance the research mandate of the department. Funding (also referred to 'k') is limited resulting in strong competition for the small amount of funds available.

The solution requires engagement of COM, SHA and MOH around the development of a similar Vison, Mission and Values to do with Academic Health Care-and to follow that up with a 'default academic contract' similar to that of Western (UWO)-as discussed below.

Clarity around the role and treatment of PhDs involved in clinical service is also required.

k) Identify any challenges associated with advancing the department's research agenda.

1. Increased leverage of potential

The department, as with many other clinical departments in the COM, faces a high clinical service demand leading to a lack of faculty with 'protected time' for research. While Laboratory Medicine has a long history of successful research, traditionally this has been limited to an academic minority working in a somewhat 'isolated milieu'. Our Department has some highly successful researchers with CIHR success but in the process of a Departmental retreat we have recognized

the need to promote involvement of many other departmental members in research initiatives. Today our Department stands on a number of cusps-structural-the transition to a provincial laboratory system is underway and gaining speed, educational-Competence by Design will be introduced to our residency program in July of 2019 and technological-a genomic revolution is under way in all of our diagnostic Laboratories. **The ability of our Department to leverage the potential for research opportunities provided by these changes would be greatly enhanced by the capacity to fund selected projects within our practice**.

Such funding would provide opportunities for PALM to honor the vision (to become leaders in improving the health and well-being of the people of Saskatchewan and the world) and mission (to improve health through innovative and interdisciplinary research and education) of the COM by allowing a 'micro-financing' approach to spread research capacity and improved clinical care through a distributed multidisciplinary system comprising over 60 clinicians and 1400 scientists of varying backgrounds. Potential exists for improved health outcomes for the patients of Saskatchewan from initiatives as diverse as greater leverage of 'Point of Care' technology and telemedicine, engagement with indigenous communities around even more implementation of genomic testing for infectious disease (GenXpert), educational projects around enhanced test utilization by primary care providers, or more detailed outbreak analysis to improve public health.

We see such funding as an opportunity to host departmental competitions for research funding, to institute a departmental research day, promote resident involvement in research, and enhance knowledge translation by fostering a culture of multidisciplinary and distributed inquiry.

2. Contracts

The 'default' contract for all faculty in health care in Western (UWO) is one that devotes 80% of time to clinical service and 20% to 'Academic 'pursuits. SHA does not articulate or facilitate such a clear commitment to the academic mandate. Promotion of such a culture by means of Western type contracts would result in a significant increase in academic productivity and of optimized patient care. Implementation of a number of Physician Scientist contracts-with an even greater 'academic' component would not only promote enhanced academic productivity but would lead to an unstoppable adoption of a 'knowledge culture' within the department.

The issue of PhD status is a continuous risk for SHA/COM. As noted earlier by some PhD faculty (Section 3, Dr A. Lyon)-the PhD staff (particularly those involved in a significant amount of clinical service) do not feel appreciated. Given that that integration of Laboratory Practice in BC is anticipated to lead to recruitment of up to 40 FTEs in Laboratory Medicine this is a significant area of risk for Saskatchewan.

3. Skill sets

One very obvious skill set lacking in a department of many skills is that of individuals with skills in the area of Informatics. The addition of two scientists with this skill would enhance many other research areas inside and outside the department.

Please see Departmental Research SWOT in Appendix 5.

Dr. Joseph Blondeau
MAY 2020

The Antimicrobial Research Program at Royal University Hospital and the University of Saskatchewan has been investigating antimicrobial agents for the past 29 years. It is an international recognized program. Over the past 10 years, part of the focus has been with “One Health” and investigations with pathogens and antibiotics important in both human and animal health.

Key areas of investigation include *in vitro* susceptibility testing of new antimicrobial agents, antimicrobial resistance, mutant prevention concentration testing against a wide range of bacterial pathogens and drugs (new and old) and *in vitro* kill assays. We are also interested in drug combinations. More recently transmission of animal pathogens to humans has been a focus. We investigate new products and methods for our diagnostic clinical microbiology laboratory. Consideration of drug pharmacology along with minimum inhibitory and mutant prevention drug concentration is a natural extension of *in vitro* investigations. A wide variety of methods and technologies are utilized including various molecular assays and sequencing.

Dr. John DeCoteau
13 MAR 2020

Advanced Diagnostics Research Laboratory (ADRL)

The ADRL contributes to excellence in cancer care through a robust R&D capacity that allows it to keep pace with cancer discovery and rapidly respond to the clinical demands for developing, validating, and implementing new companion diagnostics. Please see Section 3.

RESEARCH FUNDING AWARDED LAST FIVE YEARS

DeCoteau J (Principle Investigator). Astra Zenca. Assay Development Grant: Validation study to implement liquid biopsy monitoring of the EGFR T790M resistance allele at the Advanced Diagnostics Research Laboratory. Description: One time unrestricted grant providing support to establish plasma monitoring of the EGFR T790M resistance allele by next generation sequencing of cell free DNA. Awarded: October 2019; **$42,000** total

DeCoteau J (Principle Investigator). Saskatchewan Centre for Patient Oriented Research (SCPOR). Test Development Grant. Description: SCPOR matching grant program funded by CIHR and partners. The tests developed with this funding support translational and patient oriented research with an aim to enter the clinical arena in the near term. Awarded: May 2015; Active July 2015-June 2020; **$500,000** total

Stakiw J and DeCoteau J (Co-Principle Investigators). Saskatchewan Cancer Agency Operating Grant: Role of the Bone Marrow Microenvironment in Multiple Myeloma Development and Progression. Description: New operating grant to assess minimal residual disease and components of the bone marrow microenvironment in multiple

myeloma patients using 10 color flow cytometry. Awarded: April 2017; Active: July 2017 to June 2019; **$199,200** total

Bosch M and DeCoteau J (Co-Principle Investigators). Saskatchewan Cancer Agency Operating Grant: Predicting and Preventing Relapses in Non-Hodgkin's Lymphoma. Description: New operating grant to develop state of the art molecular monitoring tools for NHL patients using Next Generation Sequencing (NGS) analysis of plasma samples. Awarded: April 2016. Awarded: April 2016; Active: July 2016 to June 2018; **$200,000** total

DeCoteau J (Principle Investigator). Alexion Pharma Canada. Assay Development Grant: 10 Color Flow Cytometry Assay for Monitoring Patients with Paroxysmal Nocturnal Hemoglobinuria (PNH); Description: One time unrestricted grant providing salary and reagent support to establish and validate PNH monitoring in Saskatchewan by 10-color flow cytometry. Awarded: March 2016; **$30,000** total

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Dr. Andrew Freywald
Research Activity Report (December 2015 – current)

Our research program is focused on identifying molecular mechanisms that determine tumor aggressiveness and drug resistance with the ultimate goal of targeting these mechanisms for therapeutic purposes. To achieve this, we have been actively collaborating with a broad network of research groups both at the University of Saskatchewan (U of S), across Canada and abroad **(Appendix 1)**. Within our research program, we have been training multiple honors and graduate students, and postdoctoral fellows. One of these fellows, Dr. Behzad Toosi, has been selected for the position of a Research Chair in Oncology at the College of Veterinary Medicine at our University. Another fellow, Dr. Amr El Zawily is currently a faculty member at the University of Iowa, USA. We keep an active collaboration with both scientists.

In addition to supervising our research projects, I have been also serving as a member of the Scientific Board at the Biomirex Inc (MA, USA), a biotech company developing novel therapeutic and diagnostic synthetic antibodies. This helps us to develop therapeutic reagents for our newly discovered cancer-promoting molecular targets.

Since December 2015, we have secured ~$2.8 million in research grants (**Appendix 2**) from competitive granting agencies (including CIHR, The Cancer Research Society, Terry Fox Research Institute, Saskatchewan Cancer Agency and SHRF) to support our investigations. This helped us to publish 22 peer-reviewed articles (some of them in very high impact journals with impact factors above 9, **Appendix 3**), file a patent application related to cancer treatment and test novel therapeutic compounds in very advanced models, including 3-d cell culture, and patient-derived xenografts.

In addition to all this, I have been serving as a member of the Cancer Progression and Therapeutics (CPT) CIHR project grant review committee, which further improved representation of our College at the Canadian cancer research landscape.

Collaboration Network (December 2015 – current)

1. University of Saskatchewan
1.1 College of Medicine
1.1.1 Department of Pathology
- Dr. Rani Kanthan
- D. John DeCoteau
- Dr. Ron Geyer
- Dr. Maruti Uppalapati
- Dr. Henrike Rees

1.1.2 Other Departments at the College of Medicine
- Dr. Scot Leary (Biochemistry, Microbiology and Immunology)
- Dr. Humphrey Phonge (Medical Imaging)
- Dr. John Howland (Anatomy, Physiology and Pharmacology)
- Dr. Darrell D. Mousseau (Department of Psychiatry)

1.2 College of Pharmacy and Nutrition
- Dr. Robert Laprairie
- Dr. Meena Sakharkar

1.3 College of Arts and Science
- Dr. Tony Kusalik (Computer Science)
- Dr. Eric Price (Chemistry)

1.4 College of Veterinary Medicine
- Dr. Behzad Toosi (Small Animal Clinical Sciences)

2. Saskatchewan Cancer Agency
- Dr. Franco Vizeacoumar
- Dr. Deborah Anderson
- Dr. Jim Xiang
- Dr. Sunil Yadav

3. Rosalind and Morris Goodman Cancer Research Centre (Montreal)
- Dr. Peter Seigal

4. Université Laval
- Dr. Nicolas Bisson

5. University of British Columbia
- Dr. Judy Wong
- Dr. Artem Cherkasov

6. Queens's University (Kingston)
- Dr. Madhuri Koti

7. University of Utah
- Dr. Alana Welm

8. The Sloan-Kettering Institute for Cancer Research (New York)
- Dr. Juha Himanen

9. University of Iowa

- Dr. Amr El Zawily

10. University of Maryland
- Dr. Eytan Ruppin

Research Funding (December 2015 – current)

1. A systematic genome wide effort to identify and validate targetable synthetic dosage lethal
interactions of mitotic kinases in colorectal cancer cells.
Canadian Institutes of Health Research (CIHR)
Total Funding - **592,875**

2. Targeting the EphA2 receptor in triple-negative breast cancer
Canadian Institutes of Health Research (CIHR)
Total Funding - **558,452**

3. Targeting EphB6-deficiency in breast cancer
University of Saskatchewan College of Medicine, CIHR Bridge funding
Total Funding - **100,000**

4. Prairie Cancer Research Consortium projects
Terry Fox Research Institute (TFRI)
Total Funding - **600,000**

5. Developing combination therapy to treat androgen-insesitive prostate cancer
Saskatchewan Health Research Foundation (The) (SHRF)
Total Funding - **120,000**

6. Identifying EphB6-deficient breast cancer tumors for clinical trials
Saskatchewan Cancer Agency
Total Funding - **163,350**

7. New targets for metastatic breast cancer
Saskatchewan Cancer Agency
Total Funding - **200,000**

8. The role of mitochondrial fission in triple-negative breast cancer tumor-initiating cells
College of Medicine, U of S, CoMRAD grant
Total Funding - **29,522**

9. Polokinase and drug resistance in pancreatic cancer
Cancer Research Society (The)
Total Funding - **120,000**

10. New Therapies for Luminal A and Triple Negative Breast Cancer
College of Medicine, University of Saskatchewan, CIHR Bridge Funding
Total Funding - **100,000**

11. Targeting chromosomal instability by synthetic dosage lethality
College of Medicine, University of Saskatchewan, CIHR Bridge Funding
Total Funding - **100,000**

12. Research Study to Initiate a Clinical Trial for Targeting Synthetic Lethality between EPHB6
and SRC in Breast Cancer
Saskatchewan Health Research Foundation (The) (SHRF)
Total Funding – **49,858**

13. Targeting resistance to anti-EphA2 treatment in breast cancer
College of Medicine, University of Saskatchewan, CoMRAD grant
Total Funding - 29,739

Peer-reviewed publications and patent applications (December 2015 – current)

1. Denomy C, Germaine S, Haave B, Vizeacoumar FS, **Freywald A**, Weaver BA, Vizeacoumar FJ. (2019). Banding Together: A Systematic Comparison of the Cancer Genome Atlas and the Mitelman Database. Cancer Research. 79: 5181-5190.

2. Parameswaran S, Vizeacoumar FS, Bhanumathy KK, Quin F, Islam FM, Toosi B, Cunningham CE, Mousseau DD, Uppalapati M, Stirling PC, Wu Y, Bonham K, **Freywald A**, Li H and Vizeacoumar FJ. (2019). Molecular characterization of an MLL1 fusion and its role in chromosomal instability. Molecular Oncology. 13(2): 422-440.

3. Parameswaran S, Kundapur D, Vizeacoumar FS, ***Freywald A**, *Uppalapati M and *Vizeacoumar FJ. (2019). A road map to personalizing targeted cancer therapies using synthetic lethal approaches. *(*Corresponding author)*. Trends in Cancer. 5(1): 11-29.

4. Cunningham CE, MacAuley MJ, Yadav G, Vizeacoumar FS, ***Freywald A**, *Vizeacoumar FJ. (2019). Targeting the CINful genome: Strategies to overcome tumor heterogeneity. *(*Corresponding author)*. Progress in Biophysics & Molecular Biology. 147: 77-91.

5. Xie Y, Wu J, Xu A, Ahmeqd S, Sami A, Chibbar R, **Freywald A**, Zheng C, Xiang J. (2018). Heterologous human/rat HER2-specific exosome-targeted T cellvaccine stimulates potent humoral and CTL responses leading to enhancedcircumvention of HER2 tolerance in double transgenic HLA-A2/HER2 mice.Vaccine. 36: 1414-1422.

6. Tan X, Xu A, Zhao T, Zhao Q, Zhang J, Fan C, Deng Y., **Freywald A**, Genth H, Xiang J. (2018). Simulated microgravity inhibits cell focal adhesions leading to reduced melanoma cell proliferation and metastasis via FAK/RhoA-regulated mTORC1 and AMPK pathways.Scientific Reports. 8: 3769-3781.

7. Nyarko JNK, Quartey MO, Heistad RM, Pennington PR, Poon LJ, Knudsen KJ, Allonby O, El Zawily AM, **Freywald A**, Rauw G, Baker GB, Mousseau DD. (2018). GlycosylationStates of Pre- and Post-synaptic
Markers of 5-HT Neurons Differ With Sex and5-HTTLPR Genotype in Cortical Autopsy Samples. Frontiers in Neuroscience. 12: 545-61.

8. Toosi B, El Zawily A, Truitt L, Shannon M, Allonby O, Babu M, DeCoteau J, Mousseau D, Ali M, Freywald T, Gall A, Vizeacoumar FS, Kirzinger MW, Geyer CR, Anderson DH, Kim T, Welm AL, Siegel P, Vizeacoumar FJ, *Kusalik A, ***Freywald A**. (2018). EPHB6 augments both development and drug sensitivity of triple-negative breast cancer tumours. *(*Corresponding author).* Oncogene. 37: 4073-4093.

9. Jing A, Vizeacoumar FS, Parameswaran S, Haave B, Cunningham CE, Wu Y, Arnold R, Bonham K, **Freywald A**, Han J and Vizeacoumar FJ. (2018). Expression-based analyses indicate a central role for hypoxia in driving tumor plasticity through microenvironment remodeling and chromosomal instability. NPJ
Systems Biology and Application. 4: 1-10.

10. Xu A, Zhang L, Yuan J, Babikr F, **Freywald A**, Chibbar R, Moser M, Zhang W, Zhang B, Fu Z, Xiang J. (2018). TLR9 agonist enhances radiofrequency ablation-induced CTL responses, leading to the potent inhibition of primary tumor growth and lung metastasis. Cellular & Molecular Immunology. 16: 820-832.

11. Mu C, Zhang X, Wang L, Xu A, Ahmed KA, Pang X, Chibbar R, **Freywald A**, Huang J, Zhu Y, Xiang J. (2017). Enhanced suppression of polyclonal CD8+25+ regulatory T cells via exosomal arming of antigenspecific peptide/MHC complexes.Journal of Leukocyte Biology. 101: 1221-1231.

12. Auslander N*, Cunningham CE, Toosi B, McEwen E, Yizhak K, Vizeacoumar FS, Parameswaran S, Gonen N, Freywald T, Bhanumathy KK, **Freywald A***, Vizeacoumar FJ* and *Ruppin E*. (2017). An integrated computational and experimental study uncovers the complex role for FUT9 as a metabolic driver of colorectal cancer. *(*Corresponding author)*. Molecular Systems Biology. 13: 956-971.

13. Xu A , Wang R , **Freywald A** , Stewart K , Tikoo S , Xu J , Zheng C , Xiang J. (2017). CD40 agonist converting CTL exhaustion via the activation of the mTORC1 pathway enhances PD-1 antagonist action in rescuing exhausted CTLs in chronic infection. Biochemical and Biophysical Research Communications. 484: 662-667.

14. El Zawily A., McEwen E., Toosi B., Vizeacoumar F.S., Freywald T., *Vizeacoumar F.J., and ***Freywald A**. (2017). The EphB6 receptor is overexpressed in pediatric T cell acute lymphoblastic leukemia and increases its sensitivity to doxorubicin treatment. *(*Corresponding author).* Scientific Reports. 7: 14767-76.

15. Xu A, **Freywald A**, Xie Y, Li Z, Xiang J. (2017). CD8+ memory T-cell inflation renders compromised CD4+ T-cell-dependent CD8+ T-cell immunity via naïve T-cell anergy. Immunotargets Ther. 6: 39-49. Published

16. Wang R, Xu A, Zhang X, Wu J, **Freywald A**, Xu J, Xiang J. (2017). Novel exosome-targeted T-cell-based vaccine counteracts T-cell anergy and converts CTL exhaustion in chronic infection via CD40L signaling through the mTORC1 pathway. Cellular and Molecular Immunology. 14: 529-545.

17. El Zawily A, Toosi B, Freywald T, Indukuri V, Vizeacoumar FJ, *Leary S, ***Freywald A**. (2016). The intrinsically kinase-inactive EPHB6 receptor predisposes cancer cells

to DR5-induced apoptosis by promoting mitochondrial fragmentation. *(*Corresponding author).* Oncotarget. 7: 77865-77877.

18. Xu A , **Freywald A** , Xiang J. (2016). Novel T-cell-based vaccines via arming polyclonal CD4(+) T cells with antigen-specific exosomes. Immunotherapy. 8: 1265-1269.

19. Cunningham CE, Li S, Vizeacoumar FS, Bhanumathy KK, Lee JS, Parameswaran S, Furber L, Abuhussein O, Paul JM, McDonald M, Templeton SD, Shukla H, El Zawily AM, Boyd F, Alli N, Mousseau DD, Geyer R, Bonham K, Anderson DH, Yan J, Yu-Lee LY, Weaver BA, Uppalapati M, Ruppin E, Sablina A, **Freywald A**, Vizeacoumar FJ. (2016). Therapeutic relevance of the protein phosphatase 2A in cancer. Oncotarget. 7: 61544-61561.

20. Paul JM, Toosi B, Vizeacoumar FS, Kalyanasundaram Bhanumathy K, Li Y, Gerger C, El Zawily A, Anderson DH, Mousseau D, Kanthan R, Zhang Z, *Vizeacoumar FJ, ***Freywald A**. (2016). Targeting synthetic lethality between the SRC kinase and the EPHB6 receptor may benefit cancer treatment. *(*Corresponding author)*. Oncotarget. 7: 50027-50042.

21. Zhao T, Tang X, Umeshappa CS, Ma H, Gao H, Deng Y, **Freywald A**, Xiang J. (2016). Simulated microgravity promotes cell apoptosis through suppressing Uev1A/TICAM/TRAF/NF-KB-regulated antiapoptosis and p53/PCNA- and ATM/ATR-Chk1/2-controlled DNA-damage response pathways. Journal of Cellular Biochemistry. 117: 2138-48.

22. Xu A, Bhanumathy KK, Wu J, Ye Z, **Freywald A**, Leary SC, Li R, Xiang J. (2016). IL-15 signaling promotes adoptive effector T-cell survival and memory formation in irradiation-induced lymphopenia. Cell and Bioscience. 6: 30 (1-13).

Patent application: “Methods of Identifying Patients for Treatment and Treating Patients with an EphB6 Deficiency.” United States. 62/358,393. 2016/07/05. Patent Status: Pending

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Dr. Ronald C. Geyer
MAR 2020

Dr. Geyer conducts clinical research in areas of molecular diagnostics, molecular imaging, and image-guided surgery, and targeted immunotherapy. Within the Pathology Department, Dr. Geyer is co-director of the Advanced Diagnostic Research Laboratory (ADRL) and has Saskatchewan Health Authority (SHA) approved practitioner privileges in laboratory medicine for diagnostic molecular biology and pathology. In ADRL, Dr. Geyer is responsible for developing and validating in vitro diagnostic assays for use in the SHA. His research program in the Translational Cancer Research Cluster and the Centre for Biologic Imaging Research and Development (C-BIRD) in the College of Medicine has developed in vivo imaging probes for positron emission tomography (PET) and image-guided surgery. Dr. Geyer’s experience and expertise in translating molecular diagnostic assays to the clinical and in establishing a pipeline to move imaging probes into clinical trials

provides a valuable resource for the clinical research community to translate their ideas from the bench to bedside. Dr. Geyer's research is at the forefront of the burgeoning field of precision medicine, where therapies and monitoring strategies are being tailored to individual patients. The molecular-targeted imaging probes developed by Dr. Geyer are set to undergo clinical validation and are positioned to be the first of their type in the clinic. This will provide Saskatchewan patients and clinicians access to state of the art cancer imaging and surgery technologies. Dr. Geyer's clinical studies are establishing the expertise and infrastructure necessary to train clinicians to use these imaging probes in the clinic at RUH, enhancing patient care through better cancer diagnostic and monitoring assays and improving surgical outcomes.

As **Nutrien Chair**, Dr. Geyer's research is focused on developing and validating novel antibody-based imaging probes for clinical applications in molecular diagnostics, surgery, and immunotherapy. Support from the Nutrien Chair is enabling Dr. Geyer's research team to develop: (i) a positron emission tomography (PET) imaging probe for diagnosing and monitoring cancers, (ii) an optical imaging probe that assist surgeons in resecting tumors, and (iii) engineered immune cells that target and destroy cancers. This year, Dr. Geyer will translate his basic research in PET imaging and image-guided surgery to the clinic. Dr. Geyer hopes to complete two Phase I/II clinical trials. The first clinical trial will validate a PET imaging probe to detect lung and colorectal cancers and the second trial will validate an optical imaging probe that illuminates lung cancer tumors, providing more accurate tumor resection. Dr. Geyer has also established a novel strategy to target immune cells to specific cancers to improve cell immunotherapy outcomes. He hopes to finish the preclinical validation of this immunotherapy this year.

Dr. Marilyn Kinloch
MAR 2020

RECOGNITIONS

2015/6
Best Fellowship Poster, UBC Pathology Day, UBC

2019/11
Dean's Project, 2nd Prize, Oncology Supervisor, U of S

2019/11
Dean's Project Award, 1st Place, Quality Improvement Supervisor, U of S

2019/5
Hometown Heroes, Soroptomist Saskatoon

RESEARCH FUNDING

2019/12-2021/12 (Co-applicant) **$5,050** U of S
Department of Pathology & Laboratory Medicine Research Funding

Molecular and immunohistochemical characterization of HPV-independent squamous precursor lesions in the vulva and oral cavity: Improving diagnostic accuracy and opportunity for early intervention.

201912-2020/12 (Principal applicant) **$3,345** U of S
Department of Pathology & Laboratory Medicine Research Funding
Evaluation of Discordant Mismatch Repair Immunohistochemistry, Germline and Tumour Testing in Colorectal and Gynecological Cancers

2018/2-2019/1 (Principal applicant) **$1,980** U of S
Office of the Vice President Resident Research Funding
B-catenin mutations in stratifying low-risk endometrial carcinomas

20177-20187 (Co-investigator) **$2,000** U of S
Office of the Vice President of Research Resident Research Grant
POLE mutations in Clear Cell Endometrial Carcinoma

2017/5-2018/5 (Principal Applicant) **$10,000** Royal University Hospital Foundation
RUH Foundation Research Grant
Can Molecular Subtyping Predict which Endometrial Cancers will Recur?

2020/2-2022/3 (Co-investigator) **$180,000** SHRF
Sprout Grant (Saskatcchewan Health Research Foundation)
Empowering Women using Molecular Diagnostic Testing to Improve Endometrial Cancer Care

RESEARCH FUNDING APPLICATION ASSSESSMENT ACTIVITIES

Committee Member, Women Leading Philanthropy, Organization, Academic Reviewer, Royal University Hospital Foundation

PUBLICATIONS

Journal Articles

1. Baniak N, Fadare O, Köbel M, DeCoteau J, Parkash V, Hecht JL, Hanley KZ, Gwin K, Zheng W, Quick CM, Jarboe EA, Liang SX. (2019). Targeted Molecular and Immunohistochemical Analyses of Endometrial Clear Cell Carcinoma show that POLE mutations and DNA Mismatch Repair Protein Deficiencies are Uncommon.American Journal of Pathology. 43(4): 531-537.

2. Baniak N, Decoteau J, Gilks B. (2019). Diagnostic Variation in p53 Usage for Endometrial Carcinoma Diagnosis: Implications for Molecular Subtyping. International Journal of Gynecologic Pathology.

3. Pors J, Cheng A, Leo JM, Gilks B, Hoang L. (2018). A Comparison of GATA3, TTF1, CD10, and Calretinin in Identifying Mesonephric and Mesonephric-like Carcinomas of the q Gynecologic Tract. American Journal of Surgical Pathology. 42(12): 1596-1606.

4. Hoang L, Grondin K, Lee CH, Ewanowich C, Kobel M, Huntsman D, McAlpine J, Soslow R, Gilks B. (2017). Interobserver Agreement in Endometrial Carcinoma Histotype Diagnosis Varies Depending on The Cancer Genome Atlas (TCGA)-based Molecular Subgroup. American Journal of Surgical Pathology. 41(2): 245-252.

5. Bakhsh S, Hoang LN, Soslow RA, Köbel M, Lee CH, McAlpine JN, McConechy MK, Gilks CB. (2016). 2016 May;68(6):916-24. Histopathological features of endometrial carcinomas associated with *POLE* mutations: implications for decisions about adjuvant therapy.. Histopathology. 68(6): 916-24.

Book Chapters

1. Lynn Hoang Mary Kinloch. (2019). Inflammatory Diseases of Vulva. Marissa Nucci Carlos Parra-Herran. Gynecologic Pathology. 2

2. Erica Schollenberg, Anna F. Lee, Jefferson Terry, Mary Kinloch. (2019). Placenta and Pregnancy-Related Diseases. Wenxin ZhengOluwole FadareCharles Matthew QuickDanhua ShenDonghui Guo. Gynecologic and Obstetric Pathology. (2): 493-539.

Clinical Care Guidelines

1. Canadian consensus guidelines for benign endometrial pathology reporting in biopsy material. (2018). http://dx.doi.org/doi: 10.1097/PGP.0000000000000481
Number of Contributors: 9
Contributors: Parra-Herran C, Cesari M, Djordjevic B, Grondin K, Kinloch M, Köbel M, Pirzada A, Plotkin A, Gilks B

Conference Publications

1. Bell C., Decoteau J., Kinloch M. (2020). A Patient's Best Chance: Statistical Modelling in Precision Medicine for Lung Cancer. United States and Canadian Association of Pathology, United States, Conference Date: 2020/3

Dr. Erick McNair
MAR 2020

RESEARCH

How my research agenda aligns with its strategic plan and strategic priorities.

Collaboration is central to my program of research. While maintaining the departmental priorities, my evidence-based research aims to compliment service, learning, and patient treatment.

Is the researcher meeting self- identified research productivity goals?

As new faculty, with 75% protected time towards research, I am working towards a consistent track record of research productivity. Over the past 5 years I have authored or coauthored 7 papers, 7 abstracts, 3 posters, and presented at 4 medical conferences. I have received local funding as a PI of over $150,000. I am hopeful that my perseverance and production of publishable preliminary data has placed me in the position to secure national funding and continue to increase our research productivity.

Departmental mentorship for new researchers.

I feel that the department is lacking a structured mentorship program which should be initiated on day one of the appointment of new faculty. Implementation of such a program would be extremely helpful in providing overall direction, act as a liaison between new faculty and administration for allocation of start-up funds, provide guidance on internal and external funding opportunities, reviewing of initial grant applications, provide their experience in avoidance of pitfalls, and helping new faculty to stay on track towards tenure with structured semi-annual meetings.

Despite the lack of a structured departmental mentorship program, Drs. Magee and Radomski have worked together to develop mentors for me in the COM, but only after my second year in a tenure track position.

PAPERS IN REFEREED JOURNALS

2020-01	Spurr S; Bally J**, McNair E**. (2020). The Prevalence of Undiagnosed Prediabetes/Type 2 Diabetes, Prehypertension/Hypertension and Obesity Among Ethnic Groups of Adolescents in Western Canada. BMC Pediatrics. In Press. *Role: writing editing and production of figures and tables*
2019-04	Spurr S, Bally J, **McNair E**. (2019). Prediabetes: An Emerging Public Health Concern in Adolescents. Endocrinology Diabetes & Metabolism, Apr 2:1-7. *Role: writing editing and production of figures and tables*
2018-09	**Bezaire J**, Thomson D, **McNair E***. (2018). Recombinant factor VIII measurement in a Hemophilia A patient undergoing cardiopulmonary- bypass supported cardiac surgery. Journal of ExtraCorporeal Technology Sep 50:170-7. *Role: Supervisor of student, senior and corresponding author*
2018-09	Pearce C, Bryce R, **Islam N**, **McNair E***. (2018). AGE:RAGE Axis in Coronary Stent Restenosis: A Prospective Study. International Journal of Angiology Sep 27(04): 213-222. *Role: Senior and corresponding author*
2016-05	Pearce C, Qureshi M, Prasad K. **McNair E***. (2016). Atherosclerosis and the Hypercholesterolemic AGE-RAGE Axis. International Journal of Angiology 25(2):110-116. *Senior and corresponding author*

2015-05 **Bally C**, Thomson D, Gamble J, Marcoux J-A, **McNair E***. (2015). Bivalirudin as an adjunctive anticoagulant to heparin in the treatment of heparin resistance during cardiopulmonary bypass-assisted cardiac surgery. Perfusion 31(3):189-199. *Role: Supervisor of student, senior and corresponding author*

2015-06 **Bally C**, Qureshi M, **McNair E***. (2015). Performance Evaluation of the Plateletworks® in the Measurement of Blood Cell Counts as compared to the Beckman Coulter Unicel DXH 800. Journal of ExtraCorporeal Technology Jun 47(2):113-118. *Role: Supervisor of student, senior and corresponding author*

Invited Presentations

2019-1 **McNair E**. (2019). Blood conservation During Cardiac Surgery. 21st Annual Update on Perfusion Conference Medical University of South Carolina, USA. October 25th - 26th.

Non-Invited Presentations

2019-03-08 **McNair E**. Blood conservation during Cardiac Surgery American Society of Extracorporeal Technology (AmSECT) 57th International Conference; Mar 8- 10, 2019; Nashville, TN, USA.

2018-08-20 **McNair E**. The Interplay of the AGE:RAGE Axis in Coronary Stent Restenosis: A Prospective Study. 60th Anniversary World Congress-International College of Angiology; Aug 20-21, 2018; Jikei University Medical School, Tokyo, Japan.

2018-05 **McNair E**. Novel techniques of blood conservation during and after cardiopulmonary bypass supported cardiac surgery. Department of Surgery Faculty Research Day; May, 2018; Saskatoon City Hospital, Saskatoon, Saskatchewan.

2017-10 **McNair E**, Bally J. Interprofessional Education in Pediatric Nursing. Tagging the Summit Together: International Society for the Scholarship of Teaching and Learning (ISSoTL) Conference; Oct 11-14, 2017; Calgary, Alberta, Canada.

2017-05 **McNair E**, Pearce C. The AGE: RAGE Axis and Coronary Intervention. Department of Medicine Research Day; May, 2017 University of Saskatchewan, Saskatoon, Saskatchewan, Canada.

2017-04 **McNair E**. Bivalirudin as an Adjunct anticoagulant to heparin in the treatment of heparin resistance during cardiopulmonary bypass-assisted cardiac surgery. Department of Surgery Faculty Research Day; Apr, 2017. University of Saskatchewan, Saskatchewan, Canada.

Dr. Anurag Saxena

Since resuming his leadership role in medical education at the College of Medicine, Deanery, Dr. Saxena's research interests have been in medical education, and healthcare services, especially in leadership and administrative sciences and strategy and policy in these two areas. He is involved in studying organizational change, culture, implementation of strategic initiatives, engagement and alignment, leadership development, leadership across organizational boundaries and various aspects of medical education processes.

Peer-reviewed publications

1. Saxena A, Meschino D, Hazelton L, Chan M-K, Benrimoh DA, Matlow A, Dath D, Busari J. Power and physician leadership. BMJ Leader. 2019, Published Online First: 15 July 2019. doi:10.1136/leader-2019-000139
2. Saxena A. Transformative Learning: Promise, Premise and Challenges. Medical Education.2019, 53: 534-536.
3. Saxena A, Lawrence K, Desanghere L, Smith-Windsor T, White G, Florizone D, McGartland S, Stobart K. Challenges, success factors and pitfalls in the implementation of distributed medical education. Medical Education 2018; 52: 1167-1177.
4. Saxena A. Physician leadership and leading across boundaries. Canadian Journal of Physician Leadership 2018, 4(4): 130-137.
5. Saxena A, Davies M, Philippon D. Structure of healthcare dyad leadership: an organization's experience. Leadership in Health Services 2018, 31(2): 238-253.
6. Khan A, Bensaleh A, **Saxena A.** Concomitant megaloblastic anemia and myelodysplastic syndrome, J Case Reports Images Pathol 2018, 4: pp (6)
7. Premkumar K, Premkumar J, Saxena A. Social accountability in medical schools versus corporate social responsibility in businesses. MedEdPublish, 2017, 6.
8. Saxena A, Desanghere L, Stobart K, Walker K, Goleman's leadership styles at different hierarchical levels in medical education. BMC Medical Education, 2017, 17(1) p 169
9. Saxena A, Desanghere L, Suryavanshi P. Developmental readiness and leadership development in medicine. BMJ Leader 2018, 2(2):71-75
10. Busing N, Rosenfield J, Rungta K, Raegele M, Warren A, right B, Walton M, Oandasan I, Sanfilippo, **Saxena A**. Smoothing the transition points in Canadian medical education. Academic Medicine 2018, 93(5):715-721
11. Ward AK, Mellor P, Smith SE, Kendall S, Just NA, Vizeacoumar FS, Sarker S, Phillips Z, Alvi R, **Saxena A**, Vizeacoumar FJ, Carlsen SA, Anderson DH. Epigenetic silencing of CREB3L1 by DNA methylation is associated with high-grade metastatic

breast cancers with poor prognosis and is prevalent in triple negative breast cancers. Breast Cancer Research **2016**, 18(1): 21 pages. doi:10.1186/s13058-016-0672-x

12. Busing N, Harris K, MacLellan A-M, Moineau G, Oandasan I, Rourke J and **Saxena A**. The future of postgraduate medical education in Canada. Academic Medicine. **2015**; 90(9):1258-1263

13. **Saxena A**, Desanghere L, Skomro RP and Wilson TW. Resident and attendings' perceptions of a night float system in an Internal Medicine program in Canada. Education for Health. **2015**; 28: 118-123.

14. **Saxena A,** Walker K, Kraines G. Towards reconciliation of several dualities in physician leadership. Healthcare Policy. **2015**; 10(3): 23-31

Conference Presentations / Abstracts

1. Card SE, **Saxena A.** Competence by Design in University of Saskatchewan (U of S) Royal College of Physicians and Surgeons (RCPSC) Programs – Are We Ready? How Do We Know? Medical Education Research Day. College of Medicine, University of Saskatchewan, June 2019.

2. Saxena A, Desanghere L, Robertson-Frey T, Lawrence K, Hayes P, Thiel J, Mendez I. (2019). Identifying strengths and challenges within surgical programs: An exploration of learning environment and learning culture. Canadian Conference on Medical Education, April 2019.

3. Desanghere L, **Saxena A**, Rohr B. (2019). Conflict management: Perspectives from a Chief Resident Workshop. Canadian Conference on Medical Education, April 2019.

4. Desanghere L, **Saxena A**, Robertson-Frey T. (2018). An exploration of learning environment, culture and associated strengths and challenges across residency training programs. International Conference on Resident Education, October, 2018.

5. Card SE, Robertson-Frey T, Desanghere, L, Rohr B, Jalbert, R, Elliott M, **Saxena A**. (2018). Competence by design: Determining learner needs. International Conference on Resident Education, October, 2018.

6. Saxena A, Desanghere L, Robertson-Frey T. (2018). Examining intimidation and harassment in medical education: Impact on learning environment and program culture. International Conference on Resident Education, October, 2018.

7. Manoharan, G & **Saxena, A**. Envisioning the development of resident wellness programs at the U of S Strategy to Action. Medical Education Research and Scholarship Day, Saskatoon, June 2018.

8. Pajic, A. & **Saxena, A.** Tailoring policies to competency based medical education in Family Medicine (Triple C) and Specialty programs (CBD). Medical Education Research and Scholarship Day, Saskatoon, June 2018.

9. Saxena, A., Desanghere, L., Robertson-Frey, T., Lawrence, K., Hayes, P., Thiel, J. & Mendes, I. An exploration of learning environment and learning culture in residency programs with a surgical component at the University of Saskatchewan. Medical Education Research and Scholarship Day, Saskatoon, June 2018.

10. Davidson, M., Desanghere, L. & **Saxena, A.** Appreciative inquiry-based improvement efforts in a residency training program. Medical Education Research and Scholarship Day, Saskatoon, June 2018.

11. Desanghere, L., **Saxena, A**., Walker, K. & Claypool, T. (2018). Sustaining personal and professional well-being in residency. Canadian Conference on Medical Education, April 2018.

12. Collins, M., Desanghere, L., Claypool, T., Walker, K. & **Saxena, A.** (2018) Resilience, well-being and quality of life: Informing wellness initiatives in medical education. Canadian Conference on Medical Education, April 2018.
13. Okunola, O., Desanghere, L.& **Saxena, A.** (2018). An exploration of problems encountered by residents in the CanMEDS roles. Canadian Conference on Medical Education, April 2018.
14. Saxena, A. & Desanghere, L. Developmental Readiness and leadership in Medical Education. TISLEP, October 2017.
15. Desanghere, L., Robertson-Frey, T & **Saxena, A.** (2017). Evaluation and enhancement of learning environment at postgraduate training sites. International Conference on Resident Education, October, 2017.
16. Saxena, A. & Desanghere, L. (2017). Continuous quality improvement in medical education. International Conference on Resident Education, October, 2017.
17. Saxena, A. & Desanghere, L. (2017). Feedback-seeking behaviours in residents: Perspectives from program directors, program administrative assistants and resident leaders. Accepted for presentation at the Association for Medial Education in Europe (AMEE) conference, August, 2017.
18. Saxena, A., Desanghere, L. & Robertson-Frey, T. (2017). Competence by design implementation and engagement of stakeholders at a Canadian medical Education Institution. Accepted for presentation at the Association for Medial Education in Europe (AMEE) conference, August, 2017.
19. Okunola, O., Rohr, B.A., Desanghere, L. & **Saxena, A.** (**2017**). Barriers and challenges to the teaching and learning of the Collaborator role: Implications for residency education. Canadian Conference on Medical Education, April 2017.
20. Robertson-Frey, T., Desanghere, L. & **Saxena, A.** (**2017**). Implementing competence by design: Methods for engaging with key stakeholders. Canadian Conference on Medical Education, April 2017.
21. Suryavanshi, P., Desanghere, L. & **Saxena, A.** (**2017**). Developmental readiness and leadership in undergraduate medical education. Canadian Conference on Medical Education, April 2017.
22. Desanghere, L. & **Saxena, A**. (**2017**). Feedback-seeking behaviors in Residents: Perspective from program directors, program administrative assistants and resident leaders. Canadian Conference on Medical Education, April 2017.
23. Saxena, A., Desanghere, L., Claypool, T. & Walker, K. (**2017**). Resident resilience, well-being and quality of life: Informing wellness initiatives in medical education. Canadian Conference on Medical Education, April 2017.
24. Pajic, A., Katz, L. & **Saxena, A.** (**2017**). System Issues related to residents in difficulty. Canadian Conference on Medical Education, April 2017.
25. Rohr, B.A., Okunola, O., Desanghere, L. & **Saxena, A.** (**2017**). Teaching and learning the CanMEDS collaborator Role- resident and program perspectives. Canadian Conference on Medical Education, April 2017.
26. Saxena A, Taber S, Desanghere L, Kennedy M, Harris K & Frank JR. Can changes to the accreditation process for Canadian residency programs lead to improved efficiency? A national pilot project. Presented: Poster at the Association for Medical Education in Europe (AMEE) annual meeting Barcelona Spain, Aug **2016**
27. Desanghere L, **Saxena A** and Kleisinger A. Experience, efficacy and motivation: Factors influencing leadership behaviors and developmental readiness in resident leaders. Presented: Poster at the International Conference on Residency Education (ICRE), October, **2016**.

28. Okunola O, Rohr BA, Desanghere L & **Saxena A.** Perceptions of resident excellence. Presented: at the International Conference on Residency Education (ICRE), October, **2016**.
29. Rohr B, Desanghere L, Okunola O & **Saxena, A.** Barriers and best practices for integrating CanMEDS health advocacy role into residency training. Presented: at the International Conference on Residency Education (ICRE), October, **2016**.
30. Okunola O, Rohr BA, Desanghere L & **Saxena A**. Resident perspectives on barriers and considerations for integrating quality improvement and patient safety into their training. Presented: at the International Conference on Residency Education (ICRE), October, **2016**.
31. Okunola O, Rohr BA, Desanghere L & **Saxena A**. Relevant and critical issues in implementing a patient safety and quality improvement program. Presented: at the International Conference on Residency Education (ICRE), October, **2016**.
32. Palen A, Babyn P, Okunola O, Desanghere L & **Saxena A**. A patient safety and quality improvement (PQSI) curriculum: A collaborative initiative between academic and clinical institutions. Presented: at the International Conference on Residency Education (ICRE), October, **2016**.
33. **Saxena A**, Desanghere L, Rohr B & Okunola O. Enhancing resident resiliency. Presented: at the International Conference on Residency Education (ICRE), October, **2016**. Published: ICRE Conference Program Booklet, Abstract # 042
34. **Saxena A,** Desanghere L, Rohr B, Katz L & Okunola O. Designing non-academic support services: An exploration of resident wellness. Presented: at the International Conference on Residency Education (ICRE), October, **2016**. Published: ICRE Conference Program Booklet, Abstract # 044
35. **Saxena A,** Desanghere L, Rohr B & Okunola O. Perspectives from residents on learning and teaching leader competencies: Barriers, challenges, and best practices. Presented: at the International Conference on Residency Education (ICRE), October, **2016**. Published: ICRE Conference Program Booklet, Abstract # 039
36. Desanghere L, Okunola O, Rohr B & **Saxena A.** Resident perceptions on Advocacy: Perspectives from Chief Resident Leaders. Presented: at the Health and Medical Education Scholarship Symposium (OHMES), Calgary, AB, Feb **2016**.
37. Desanghere L, Xiao L, Black K & **Saxena A**. Developing leadership and professional identities: Perspectives on social purposes. Presented at the Canadian Conference on Medical Education, April **2016**.
38. Xiao L, Desanghere L, Black K & **Saxena A**. Leadership and professional identity development in medical learners: Perspectives on their roles in healthcare and society. Presented at the Canadian Conference on Medical Education, April **2016**.
39. Okunola O, Rohr B, Desanghere L, McIntyre S & **Saxena A**. Integrating IMGs into Residency programs – the Saskatchewan experience. Presented at the Canadian Conference on Medical Education, April **2016**.
40. Rohr, B., Okunola, O., Desanghere, L. & **Saxena, A**. Mapping Chief resident best practices to the CanMEDS roles. Presented at the Health and Medical Education Scholarship Symposium (OHMES), Calgary, AB. February, **2016**.
41. Davidson MK, Desanghere L & **Saxena A**. Appreciative inquiry based improvement efforts in a residency training program. Presented: at the International Conference on Residency Education (ICRE), October, **2015**.
42. Harris J, Desanghere L, Geller B & **Saxena A**. Developing leadership competencies in medical education: Involvement in student government. Presented: at the International Conference on Resident Education, October, **2015**.

43. Okunola O, Desanghere L & **Saxena A**. Needs assessment for a transitional boot camp. Presented: at the International Conference on Residency Education (ICRE), October, **2015**.
44. Taber S, **Saxena A,** Desanghere L, Harris K, Kennedy M & Frank JR. (2015). Does a pre-visit, document-based review predict program quality? A national pilot project of Canadian residency education accreditation. Presented: at the International Conference on Residency Education (ICRE), October, **2015**. Published: ICRE Conference Program Booklet, Abstract # 003.
45. Saxena A, Taber S, Desanghere L, Kennedy M, Harris K & Frank JR. Can changes to the accreditation process for Canadian residency programs lead to improved efficiency? A national pilot project. Presented (oral) at the International Conference on Residency Education (ICRE), Vancouver BC, **2015**. Published: ICRE Conference Program Booklet, Abstract # 004.
46. Wycliffe-Jones K, Busing N, **Saxena A**, Raegele M, Bandiera G. Resident selection in Canada What do program directors think about best practice recommendations? Presented: Oral at at the International Conference on Residency Education (ICRE), Vancouver BC, **2015**. Published: ICRE Conference Program Booklet, Abstract # 006.
47. Wycliffe-Jones K, Busing N, **Saxena A**, Raegele M, Bandiera G. Resident selection in Canada best practice recommendations? Presented: Short communication at at the Association of Medical Education in Europe (AMEE), Barcelona, Spain, August **2016**.

Research Grant Information

1. Saxena A, Thiel J, Mendez I, Lawrence K, Desanghere L, Hayes P. Improving Learning culture in surgical programs in Saskatchewan. COMRAD **$ 18,638**. College of Medicine, University of Saskatchewan. Awarded Sep 2017.
Saxena A, Walker K, Claypool T, Desanghere L. Resident Resilience, Well-Being and Quality of Life: Informing Wellness Initiatives in Medical Education. University of Saskatchewan President's SSHRC grant. **$ 7000.00**

Dr. Rajendra K. Sharma
MAR 2020

I have had a longstanding research interest in the area of biochemical mechanisms of the signal transduction processes, with special emphasis on Ca^{2+} calmodulin (CaM)-regulated enzymes and their involvement in the regulation of both cAMP and Ca^{2+} second messenger systems, involving enzymology and signal transduction, in the areas of the cardiovascular system and colorectal cancer. Of note, the discovery of the role of lipid modification in my laboratory is likely to lead to early diagnosis and treatment of colorectal cancer. Research in the area of signal transduction and colon cancer has very well recognized our department world wide.

My extensive research is appropriate with the department research mandate. Furthermore, our department has several scientist and clinical faculty which provide a versatile opportunity for collaboration.

RECOGNITIONS

Celebrating Sharma's record of research - University of Saskatchewan. 2019
Please see link: **https://news.usask.ca/articles/colleges/2019/celebrating-sharmas-record-of-research.php**

City of Saskatoon – Commemorative Street-Naming at Aspen Ridge in Saskatoon, Saskatchewan (streets to include: Sharma Crescent, Sharma Lane, Sharma Place and Sharma Way)

Dr. Maruti Uppalapati
DEC 2015 - Present

1. Summary of Research Interests

Protein-protein interactions (PPIs) play an important role in cell signaling and maintaining cellularhomeostasis. Aberrant signaling, due to imbalance of protein expression/activity is the hallmarkof diseases such as cancer. Affinity reagents, such as antibodies, that bind to protein markers ofinterest are indispensable tools for studying cell biology. They can be used for studying proteininteractions and the underlying role of the PPIs in normal and disease conditions. In addition,these reagents are gaining prominence and utility in diagnosis and therapy, given that they can beused towards detection or inhibition of protein markers of disease.

The common theme of my research program is the application of *combinatorial protein engineering methods to develop effective affinity reagents* for applications in both basic and applied research. Over the course of my career, I have gained unique expertise in *developing small protein-domain based affinity reagents*. These reagents are 20 times smaller than antibodies but can bind target proteins with similar affinity and specificity. My current research explores three different applications where generating small, stable and reversibly folding proteins are useful:
i) Molecular imaging- Small proteins that bind to cancer cell specific biomarkers enable the detection of tumors by non-invasive molecular imaging using PET/SPECT. The small size enables better tumor penetration and rapid clearance from the bloodstream. High contrast PET/CT images can be generated in a much shorter time frame when compared to full-length antibodies.

ii) Targeting intracellular proteins- Antibodies are not suitable for inhibition of intracellular proteins as they are unstable in reducing environments. Given that small molecule inhibitors are available only for a fraction of human proteins; reliable affinity reagents are needed for studying the function of most intracellular proteins. We work with stable protein domains that lack intramolecular disulfide bonds and these proteins are well-folded in the cytoplasm.
iii) D-proteins- are an emerging class of affinity reagents that are small, stable, resistant to proteolysis and non-immunogenic; making them ideal affinity reagents for *in vivo* applications. D-proteins are enantiomers of natural proteins that are completely made of D-amino acid isomers. Since D-amino acids are not compatible with ribosomal protein synthesis, D-proteins are accessible only by chemical polypeptide synthesis techniques. Given that only small proteindomains (< 60 amino acids long) are

amenable for large-scale peptide synthesis, our research is well-suited to develop such reagents.

As part of collaborative applied research, I am leveraging my expertise in combinatorial protein engineering methods to *develop fully-human antibodies for anti-cancer research*. In collaboration with experts in nuclear medicine and medical imaging, our goal is to develop antibody-radio-conjugates for radioimmunotherapy of cancer. In addition, I am interested in building upon our recent success in developing human antibodies by collaborating with researchers in Western College of Veterinary Medicine to *develop canine antibodies* towards the One Health approach. In this approach, we will be able study and develop drugs to cancers that are similar between dogs and humans.

2. Research Programs and Progress

2.1. Engineering small-protein domains as scaffolds for phage-display

While methods for antibody engineering and development are well established, development of small protein domain based reagents is relatively new and significant challenges remain. Small protein domain interfaces typically involve side-chains that are part of rigid secondary structural elements, unlike flexible loops in the antibody scaffold. Therefore, it is difficult to generate binders to a wide range of structurally diverse targets. To address this issue, we have previously engineered 27 new scaffolds with diverse shapes and folds. We used this set of libraries to significantly expand the conformational space tested and we were successful in generating affinity reagents targeting all 25 different protein targets used to validate these libraries. It is important to note that a single library was not successful against all targets, which augments the need for scaffold shape diversity.

As a new investigator at University of Saskatchewan, I have continued this line of study for improving small protein domain combinatorial libraries. Here we have addressed the issue of vast under-sampling of theoretical sequence space in combinatorial libraries. A typical phage small protein scaffold library involves generating degenerate mutations allowing all 20 amino acids to occur at 12-13 selected positions. The theoretical sequence space is ~1017 which cannot be covered in a typical phage library size of 1010. Therefore, the chance of finding affinity reagents to different targets is limited. While approaches with limited amino acid diversity (using amino acids commonly found in protein interfaces) can be used to reduce the sequence space, it often results in reagents with sub-optimal pharmacokinetic properties. We recently developed an optimal randomization strategy that encodes for all 20 amino acids while maintaining a bias for amino acids commonly found in protein-protein interaction interfaces. These superior libraries are currently being used in the lab for multiple projects described below. We also secured an industry contract based on this technology by adapting the new randomization scheme to scaffold libraries proprietary for the company Reflexion Pharmaceuticals.

Several of our previously engineered scaffolds are from proteins derived from different species. At UofS, we engineered several new scaffolds based on human protein domains, to minimize immunogenicity when used for therapeutic applications. We

have used these libraries for generating binders to protein of interest and will be submitting a manuscript based on this work.

Funding: UofS and College of Medicine startup funds, SHRF Establishment Grant, President's NSERC Fund and Industry contracts.

Trainees: Arunkumar Annan-Sudarsan (postdoctoral fellow), Hanan Babeker (graduate student) and Sherin McDonald (research assistant)

2.2. Development of imaging reagents for cancer biomarkers

Small protein domain-based affinity reagents have ideal pharmacokinetic properties for applications in development of non-invasive imaging probes. Recent progress in the field is mainly based on a bacterial origin scaffold Z-domain derived from streptococcal protein G, which has entered clinical trials for imaging breast cancer biomarker HER2. Given the platform described in the above section, we believe that we can generate a pipeline of imaging reagents that can be developed for applications in non-invasive imaging and image-guided surgery. As a proof-ofconcept, we developed several lead binders to biomarkers PVRL4 (multiple cancers) and MUC16 (ovarian cancer). These synthetic proteins bind to different epitopes on the cancer biomarkers and we are working on testing genetic fusion of different combinations of binders to improve tumor retention and delivery of drug/radionuclide conjugates. Given the strong expertise in nuclear imaging at UofS we are initiating several collaborations to test drug/radio-conjugated molecules in mice.

Funding: SHRF Establishment Grant, SHRF Collaborative Innovation Development Grant (2015-16) and College of Medicine startup funds.

Trainees: Arunkumar Annan-Sudarsan (postdoc) and Hanan Babeker (summer and graduate student)

1.3 Developing inhibitors of protein-protein interactions

Given that protein interactions are the backbone of cellular processes, we are interested in developing small proteins which disrupt key PPIs that are essential for cancer cells. It is important to note that only 30% of the genome has chemical probes/inhibitors available. Therefore, there is huge gap in the field where small protein inhibitors are much needed for validation, as genomewide screens and data-mining reveal novel potential targets for drug development. Protein-based inhibitors need special delivery methods such as gene therapy vectors for intracellular targeting of cancer cells. Therefore, it is not a practical approach when compared to small molecule drugs. Nevertheless, we propose the development of small protein-domain based inhibitors (<6 kDa), as a stepping stone towards development of small molecule drugs. These proteins can be used as probes to setup small molecule screens using fluorescence anisotropy. Moreover, protein domains can be used as crystallization chaperones to generate crystal structures for SREBP1 cytoplasmic domains. The availability of crystal structures enables computational screening and fragment-based drug design. Current projects in the lab are based on developing inhibitors to the transcription factor SREBP1, HIV-I protein Vif and protein phosphatase PP2A. We are also developing inhibitors to the extracellular domain of GPR112 (an adhesion GPCR) to inhibit its signaling. We have generated preliminary

data by generating binders to several of these proteins and are pursuing external funding to continue this line of work.

Funding: SHRF Collaborative Innovation Development Grants (2015-16 and 2016-17), CANFAR Cycle 28 Grant (2016-17)

Trainees: Shaina Templeton (graduate student), Samitha Andrehannadi (summer student), Sadullah Saba (Honors' student) and Muhammad Khalil (graduate student, co-advised)

1.4 Development of light-switchable protein interactions

Optogenetics is an emerging area of research where you can control protein localization and signaling using light. In collaboration with Dr. Andrew Wooley's lab at University of Toronto, we are developing protein binders that recognize the light or dark state conformations of given light switchable protein. To date, we have developed new optogenetic tools based on blue light switching proteins. We are currently working with far-red/infrared switchable proteins for *in vivo* applications. If successful, one can envision localized activation of drugs or CAR T-cells based
on light to minimize off-target effects.

Funding: NSERC contract from University of Toronto, President's NSERC Fund, NSERC Discovery Grant (2017-22)

Trainee: Sherin McDonald (research assistant)

1.5. Development of human origin monoclonal antibodies for radioimmunotherapy

We have setup a platform for generating fully human antibodies using phage display naïve Fab libraries. Briefly, VH3 and Vk genes were amplified from cDNA extracted from pooled human peripheral blood monocytes (Clontech), and cloned into a Fab phage-display vector for library construction. This library is effective in generating binders to cancer biomarkers. We have already generated lead monoclonal antibodies that bind to biomarkers IGF2R, PVRL4 and MUC16. We are evaluating these antibodies with collaborators (Dr. Ekaterina Dadachova and Dr. Humphrey Fonge) for imaging and radioimmunotherapy.

Funding: CIHR Project Grant (2018-23), COMRAD (2020)

Trainees: Bharathikumar Maruthachalam Vellalore, Samitha Andrahennadi, Hanan Babeker, Jaline Broqueza and Chandrabose Prabhaharan

2. ***Grants Held/Completed (December 2015-current)***

Operating Grants

1. Developing radioimmunotherapy of osteosarcoma using comparative oncology approach
CIHR Project Grant
Role: Co-Principal applicant
Total Value: **$765,000** Duration: 2018/4 - 2023/3

2. Developing reagents for radioimmunotherapy of pancreatic cancer
College of Medicine Research Award, College of Medicine, University of Saskatchewan
Role: Principal Applicant
Total Value: **$30,000** Duration: 2020/1-2020/12

3. Developing radioimmunotherapy of osteosarcoma using comparative oncology approach
College of Pharmacy and Nutrition, Grant Incentive Program, University of Saskatchewan
Role: Co-Principal applicant
Total Value: **$40,000** Duration:2018/11-2019/11

4. Targeting telomerase overexpression induced vulnerabilities in prostate cancer
College of Medicine Research Award, College of Medicine, University of Saskatchewan
Role: Principal Applicant
Total Value: **$30,000** Duration: 2019/1-2019/12

5. Small protein domain affinity reagents and D-proteins
NSERC Discovery Grant
Role: Principal Applicant
Total Value: **$105,000** Duration: 01/04/2017-31/03/2022

6. Development of protein inhibitors of SREBP1 for targeted therapy of Glioblastoma
Saskatchewan Health Research Foundation – Collaborative Innovation Development Grant
Role: Principal Applicant
Total Value: **$50,000** Duration: 01/03/2017 – 28/02/2018

7. Developing Affinity Reagents for Molecular Imaging and Therapy of Ovarian Cancer
Saskatchewan Health Research Foundation - Establishment Grant
Role: Principal Applicant
Total Value: **$120,000** Duration: 01/07/2015-30/06/2018

8. Development and License of Library of D-proteins
Reflexion Pharmaceuticals, Inc., - Industry contract
Total Value: **$40,000** (USD)

9. Developing Targeted Therapeutic Reagents for Prostate Cancer
Saskatchewan Health Research Foundation – Collaborative Innovation Development Grant
Role: Co-Principal Applicant
Total Value: **$40,000** Duration: 01/03/2016-28/02/2017

10. Development of protein-based inhibitors targeting HIV-1 Vif
Canadian Foundation for AIDS Research - Cycle 28 grant
Role: Co-Principal Applicant
Total Value: **$25,000** Duration: 01/09/2016-31/10/2017

11. Effect of Interface Area and Amino Acid Composition in Synthetic Protein Interactions
University of Saskatchewan-President's NSERC Fund - Bridge funding
Role: Principal Applicant
Total Value: **$15,000** Duration: 01/05/2015-30/04/2017

12. Chemical and Biological Switches
Sub-grant from Andrew Woolley's (University of Toronto) NSERC Discovery Grant
Role: Collaborator
Total Value: **$12,000** Duration: 01/04/2015-31/03/2016

3. Peer-reviewed publications (December 2015-current)

4.1 Woloschuk, R., Reed, M., McDonald, S., **Uppalapati, M.,** Woolley, A. (2020). Yeast Two Hybrid Screening of Photo-switchable Protein- Protein Interaction Libraries. Journal of Molecular Biology, In press, Accepted.

4.2 Yasuike, N., Blacklock, KM., Lu, HX., Jaikaran, ASI., McDonald, S., **Uppalapati, M.,** Khare, SD., & Woolley, GA. (2019). Photoswitchable Affinity Reagents: Computational Design and Efficient Red-Light Switching. Chemphotochem, 3 : 431-440.

4.3 Parameswaran, S., Kundapur, D., Vizeacoumar, FS., Freywald, A., **Uppalapati, M.,** & Vizeacoumar, FJ. (2019). A Road Map to Personalizing Targeted Cancer Therapies Using Synthetic Lethality. Trends in Cancer, 5 (1): 11-29.

4.4 Parameswaran S, Vizeacoumar FS, Kalyanasundaram Bhanumathy K, Qin F, Islam MF, Toosi BM, Cunningham CE, Mousseau DD, **Uppalapati M.,** Stirling PC, Wu Y, Bonham K, Freywald A, Li H, Vizeacoumar FJ. (2019). Molecular characterization of an MLL1 fusion and its role in chromosomal instability. Molecular Oncology, 13 (2):422-440.

4.5 Reis, JM., Xu, X., McDonald, S., Woloschuk, RM., Jaikaran, ASI., Vizeacoumar, FS., Woolley, GA., & **Uppalapati, M.** (2018). Discovering Selective Binders for Photoswitchable Proteins Using Phage Display. ACS Synthetic Biology, 7 (10): 2355-2364.

4.6 Islam, MF., Watanabe, A., Wong, L., Lazarou, C., Vizeacoumar, FS., Abuhussein, O., Hill, W., **Uppalapati, M.,** Geyer, CR., & Vizeacoumar, FJ. (2017). Enhancing the throughput and multiplexing capabilities of next generation sequencing for efficient implementation of pooled shRNA and CRISPR screens. Scientific Reports, 7 (1).

4.7 Cunningham, CE., Li, S., Vizeacoumar, FS., Bhanumathy, KK., Lee, JS., Parameswaran, S., Furber, L., Abuhussein, O., Paul, JM., McDonald, M., Templeton, SD., Shukla, H., El, Zawily AM., Boyd, F., Alli, N., Mousseau, DD., Geyer, R., Bonham, K., Anderson, DH., Yan, J., Yu-Lee, LY., Weaver, BA., **Uppalapati, M.,** Ruppin, E., Sablina, A., Freywald, A., & Vizeacoumar, FJ. (2016). Therapeutic relevance of the protein phosphatase 2A in cancer. Oncotarget, 7 (38): 61544-61561.

4. Presentations (December 2015- current)

5.1 Invited Presentations
Uppalapati M. (2018). Small protein domain affinity reagents for cancer imaging and therapy. Presented at:Tata Institute for Fundamental Research; July 27; Hyderabad, India

5.2 Contributed Presentations
Annan Sudarsan AK, Maruthachalam BV, Hill W, DeCoteau JF, Geyer CR, Vizeacoumar FJ, Uppalapati M. (2018). Engineering protein domain-based affinity reagents. Presented at: Protein Engineering Canada; June; Vancouver

5.3 Poster Presentations
Annan Sudarsan AK, Maruthachalam BV, Hill W, DeCoteau JF, Geyer CR, Vizeacoumar FJ, Uppalapati M. Generation and Characterization of Small Protein-Based Affinity Reagents for Medical Imaging. Poster presented at: Next Generation Protein Therapeutics and Bioconjugates Summit 2019; 2019 Jun; San Francisco

Babeker H, Uppalapati M. Development of small protein-based affinity reagents targeting biomarker MUC16/CA125[abstract]. Poster presented at: Next Generation Protein Therapeutics and Bioconjugates Summit 2019; 2019 Jun; San Francisco

Woloschuk RW, McDonald S, Uppalapati M, Woolley A. Two for the Price of One: Towards the Development of One Component Optogenetic Tools. Poster presented at: Protein Engineering Canada; 2018 Jun; Vancouver

Jang J, McDonald S, Uppalapati M, Woolley AG. Novel Discovery and Characterization of Cyanobacteriochrome- based Optogenetic Tools. Poster presented at: Protein Engineering Canada; 2018 Jun; Vancouver

Reis J, Xu X, McDonald S, Woloschuk R, Jaikaran A, Woolley A, Uppalapati M. Discovering Light Switchable Protein Interactions by Phage Display. Poster presented at: 31st Annual Symposium; The Protein Society; 2017 Jul 24-27; Montreal

Reis J, Xu X, McDonald S, Woolley A, Uppalapati M. Discovering light switchable protein interactions using phage display. Poster presented at: Protein Engineering Canada Conference; 2016 Jun 17-19;

Uppalapati M. Small protein-based affinity reagents for targeting cancer biomarkers. Poster presented at: The Canadian Cancer Research Conference; 2015 Nov 8-10; Montreal

5. Department and college support for research program

I would like to thank Dr. Fergall Magee for mentoring me and supporting my career development. Dr. Magee was instrumental in helping me secure research space and infrastructure needed for my research program. He was very accessible.

I would like to thank Dr. Marek Radomski for starting several initiatives that have immensely helped my research program including graduate scholarships (COMGRAD) and seed-funding (COMRAD) and collaborative cluster funding.
Current needs for my budding research program are infrastructure and research space. I am looking forward to continuing seeking support from both the Department and College as I seek funding from external sources for obtaining new infrastructure critical for accelerating my research.

Section 6 – Governance, Leadership & Administration

Section 6 – Governance, Leadership and Administration

a) Outline the current departmental governance structure and comment on its efficacy.

The Department is governed through the collective principles of consensus decision making, transparency and collaborative problem solving. Each member of the department is encouraged to grow as a leader by enhancing the quality of departmental decisions by the contribution of expert advice (please refer to powerpoint presentation in Appendix 6). Prior to integration into a single Provincial structure, the Department was governed by a Dyad Leadership (Departmental Head and Laboratory Director) working collaboratively with an Executive Committee [EC] (Medical Faculty) and a Laboratory Operations Committee (LOC). The various disciplines of laboratory medicine (Anatomic Pathology, Clinical Chemistry, Transfusion Medicine etc.-please see also Sections #2 and #3) were organized into 'divisions' who met regularly as division committees while monthly meetings of the Department Head and Laboratory Director with the Division Heads had been instituted by the current Department Head. In addition, since 2016 three monthly Departmental meetings had been instituted, while three Departmental retreats around various aspects of strategic planning for clinical services delivery, research, and educational mandates had been held. Please refer to Appendix #6 for membership and terms of reference of the EC and LOC, agendas of specific divisions, Division Head and Departmental Meetings, and proceedings for departmental retreats of 2016, 2017, 2018. To-date, retreats have occurred in Saskatoon-with invitations to attend from other sites (North Battleford and Regina). Plans for another retreat in spring of 2020 have been put on hold due to COVID-19 Pandemic-future retreats will be scheduled outside of Saskatoon-while strategic planning sessions have already occurred in Regina and other locations.

Following publication of the Kendall Report (Optimizing and Integrating Patient-Centred Care, December 2016-Please see Appendix 6), an integration process of health regions and then clinical specialties has been initiated in Saskatchewan. Transition planning for an integrated laboratory system began in SEP 2017 culminating in a Provincial Strategic Planning Event, comprising over 80 members of clinical and laboratory staff from across the province (28 NOV 2018, Regina-please see Appendix #6). This was followed by development of a Strategic Roadmap (please see also Section #2) and a new structure for a Provincial Laboratory Medicine Service. Governance of this new structure is by the collective principles of consensus decision-making, engagement of all for enhanced decision making, promotion of patient-centred culture and implementation of a provincial perspective.

Now termed SHA Provincial Program-Laboratory Medicine-this integrated system reports to Provincial Programs led by Mr. Corey Miller and Dr Paul Babyn. Other components in Provincial Programs include Diagnostic Imaging, Pharmacy, Community Care, Tertiary Care and Child and Maternal Health. The integrated laboratory services comprise 200 locations, 1500 individuals (MLTs, MLAS, CXLTs, Laboratory scientists and 60+ clinicians

two-thirds of whom are MDs while one third are PhDs), performs 25 million tests per year and has a budget of approximately $160 million dollars. Laboratory staff work all across the province but Clinical staff are located in Saskatoon and Regina and three smaller centres-North Battleford, Prince Albert and Moose Jaw. (Please see Appendix #6 for a complete list of clinical staff and locations.) The Laboratory Leadership is a Dyad comprising the Provincial Executive Director (Ms. Lenore Howey) and a Clinical Lead (Dr. Fergall Magee, Provincial Head, Laboratory Medicine). An expanded Provincial Executive Steering Committee, chaired by the Executive Director and Clinical Lead has been implemented. Two types of provincial committees report to the Executive-Provincial Discipline Specific Committee (e.g. Anatomic Pathology, Clinical Chemistry etc.)-each led by a Dyad (Clinician and Director) and Provincial Functional Committees (Quality, Transport, Information Technology)-again each led by a Dyad. For documentation on structure, committee composition and terms of reference please see Appendix #6. The intent is that the provincial discipline specific and functional committees identify service gaps and make recommendations for an improved future state. The role of the Executive Steering Committee is to provide evidence informed and ethical decision-making through a Provincial lens as to the exact sequence of next steps on the basis of greatest provincial need and potential benefit.

Comments from faculty:

- The structure of the Department/Provincial Program Laboratory Medicine is extremely complex and diverse with the overall budget around $160,000,000. It involves ~1500 people operating at more than 200 locations throughout the province. Administratively, it is structured in local discipline-specific divisions, each guided by a discipline-specific clinical lead reporting to the Department Head/Provincial Medical Director Laboratory Medicine. In addition, the Department also maintains at least five actively operating research labs, each managed by an independent investigator also reporting to the Department Head. All key decisions are being discussed at the regular Departmental meetings. The Executive Committee also meets on a regular basis and provides an advisory support for the Department Head/Provincial Medical Director Laboratory Medicine.
- I'll leave it to others to outline the structure. It is generally effective, although we are still finding our way in the new SHA structure. It has served us very well in provincial pandemic planning. Some changes are underway in the reporting structure of our local managers that are being driven by the expectation that we will align such org structures provincially, rather than because the changes actually improve their managerial effectiveness. Provincial sites away from the tertiary sites are in need of much more robust professional oversight. Those of us in the tertiary sites are unable (in terms of capacity) and unwilling (in terms of risk management) to be identified as responsible for "the rest of the province" in addition to our already full-time roles. The structure is likely fine – it needs to be adequately populated.

- Governing such a complex unit is an enormous task, nevertheless the current structure is efficient and the governance is executed in a practically optimal fashion.
- I find that the structure for Pandemic response has been effective at bringing the provincial team together to achieve common goals.
- Several changes in structure and governance occurred during Dr. Magee's first term at joint-head, which makes these questions difficult to organize. Currently Dr. Magee holds three consecutive leadership positions:
  (2 roles) -Joint Head of the Pathology and Laboratory Medicine, SHA and College of Medicine, U of S. This amalgamates two separate roles and sometimes competing or conflicting interests for separate organizations with different visions, missions and values.
  (1 role)-Head of pathology and lab medicine, Saskatoon Zone

  It is not humanely possible to succeed well at all three demanding, under-resourced and competing positions. I think that Dr. Magee has well to keep the organization going through these turbulent and resource-starved times and he and the department would benefit from some changes. I think that it would be ideal to divide the responsibilities as follows:
  Dr. Magee – Joint Head of the Pathology and Laboratory Medicine, SHA and College of Medicine, U of S.
    - Named as lab license holder for all SHA pathology & lab services in the integrated lab across the province.
    - Acts as a College of Medicine inter-departmental representative and representative to the dean.
    - Responsible for medical/scientific staff recruiting for all locations. Acts as a medical chief operations officer with several deputies for different areas

  Several helpers could be identified to share Dr. Magee's workload on a day-to-day basis:
  Candidate 1 – laboratory services medical director.
    - Co-chairs the SHA lab executive and decision-making body for lab services on behalf of Dr. Magee. (e.g. a deputy head). Works with sub-discipline leaders to manage & direct lab/pathology services.

  Candidate 2 – academic services deputy head.
    - Organizes College of Medicine responsibilities that are internal to the department on behalf of Dr. Magee. Residency directors/programs, undergrad teaching, research services, academic committees, involved with departmental rounds and other academic programs.

  Candidate 3 – Saskatoon Zone medical head of pathology and laboratory medicine. This separate individual takes responsibility for medical credentialing, represents and liaises from pathology to the Saskatoon Zone medical leadership. I suggest that all Zone Lab leaders would report to the lab executive committee, but they would not direct laboratory operations within the Zone (e.g. lab operations would be directed provincially via the Executive Committee.

b) <u>Is the current structure the correct one for pursuit and achievement of the department's strategic priorities</u>?

The current structure of Provincial Discipline Specific and Functional Committees allows the Department to deliver on its three mandates-acute

care, academia and public health on a province wide basis. Education is **distributed**-resident teaching occurs at three sites-Saskatoon, Regina and Prince Albert-and there are plans to implement opportunities for residents and **multidisciplinary** with educational opportunities offered to Sask Polytech students in Saskatoon, Regina, Rural and Northern locations. The department requires implementation of a new Area Lead in Regina and appointment of one in Saskatoon-both of these indicatives are currently underway. A more serious issue is the need for recognition of the leadership role of PhDs within our department-this will require effective discussions with the leadership of SHA. As mentioned in previous section other barriers exist to full leverage of these opportunities and include-limited human resources, and IT connectivity.

Comments from faculty:

- From my point of view as an active investigator, the structure of the Provincial Program Laboratory Medicine, although very complex, operates very well in supporting its priority in pursuing excellence in health-related research. This is evidenced by the success of our investigators in securing competitive external peer-reviewed research grants.
- Unable to comment on the enduring structure. The Pandemic response structure is effective.
- Probably. The Dyad model is a good one for labs.
- The organization structure has changed every few months during the past five years. I can no longer find a handy reference of an organizational chart to append here and comment on. This lack of a clear organizational chart, available on public websites for the lab, is a liability and contradicts lab accreditation. I think there are clear lines of authority and responsibility within each laboratory license area, which should make services safe for patients. It is not clear how authority and responsibility is organized between zones or laboratory licenses, which undermines our efficiency as an organization at present.
- No. We need to have clear representation in the Zone Medical organizations and within a provincial laboratory executive committee. We had made progress to resolving this problem, and currently have stalled. I am also concerned that Dr. Magee is under-resourced to accomplish three separate leadership roles with limited support. We have several conflicts between organizations to resolve. For example: The SHA clearly directs staff not to be involved with third party companies or organizations to avoid conflicts of interest. However; the College of Medicine encourages researchers to collaborate with industries to secure research grants and funding related to emerging healthcare topics. We also have unusual groups within our organization such as the ADRL advanced diagnostics research laboratory, organized by Dr. John DeCoteau, and might be owned by the University of Saskatchewan. *I am not aware who has legal and fiduciary responsibility for ADRL or why the SHA laboratory services are expected to pay above market prices for laboratory services provided by ADRL.*** Is ADRL external to our department or internal? I have no idea, but there appear to be conflicts of interest at several levels. I think the clinical goals of ADRL are appropriate and is serves a valuable academic role in the College of Medicine, but it is not clear if relates or reports to the Joint Department Head.

  ***This statement contains factually incorrect information. Please see a response by the Provincial Head to this statement, on page 163.*

c) Is the department's executive engaged, representative and actively involved in decision-making processes?

Yes-Laboratory leadership is committed to our three mandates and to a provincial perspective that is committed to a distributed and multidisciplinary practice with a patient-centred focus.

Frequent town halls involving the Executive Director and Clinical Lead among others to promote faculty, staff and patient engagement have occurred since the integration process began (Saskatoon, Regina, Moose Jaw, North Battleford and Prince Albert etc.).

Comments from faculty:

- No. At the first meeting of the Executive Committee I directly asked Lenore Howey to clarify if the Executive was a decision-making group. She said the Executive Committee was only for information purposes only. I disagree with that concept and hope it can be clarified in terms of reference and in future practices so the executive would clearly not be 'for information only' and the executive will establish the consensus or final decisions for the leadership dyad to enact. To comply with lab accreditation standards, I would like it clearly understood that laboratory medical/scientific staff on the executive are leading decision-making processes. (note: The Executive Committee of SHA Path & Lab Med Services is different than Dr. Magee's Dept Head Executive Committee, which is an advisory group).
- Yes, the Executive Committee is sufficiently representative, engaged on a regular basis and is actively involved in decision making based on its advisory role.
- The Pandemic response structure is engaged, representative and actively involved.
- Yes.

d) Are departmental committees effective and do they fulfill their mandates in accordance with their terms of reference?

Yes. The Executive Steering Committee and all Discipline Specific and Functional Committees have a clear provincial mandate, meet regularly and provide on-going monthly reports to Laboratory, Provincial Program and SHA Leadership-please see also section on Strategic Planning. Specific meetings are devoted to local and provincial operations (daily site or provincial huddles, pandemic planning, Exec Director/Clinical Lead-Director Meetings, local operations committee meetings, and provincial groups meetings)-please see Appendix 6 for agendas and minutes. In terms of Education, there are regular meetings of both the Residency Program Committee and the Clinical Competency Committee, regular meetings to do with undergraduate education (Dr R Jeffries, Ashley Selvig, and others) and with Sask Polytech around technologist education (Ms. Sandra Blevins, Dean of Nursing and Health Sciences, Sask Polytech). In term of academic development, a specific on-boarding practice has been implemented to promote collaboration with other departments, mentorship has been provided for specific researchers (with great support form Dr Marek Radomski and others). In addition, all USFA Faculty undergo annual Assignment of duties and a

spate Annual Review with the Provincial Head.

Comments from faculty:

- Yes, to the best of my knowledge, our committees are sufficiently effective and operate on a regular basis according to their mandates.
- I interpret this as a question of the academic department only. I do not know. I suspect that departmental committees of the academic department should report at the academic departmental meetings (PALM meetings), for example: who received funds from various departmental endowment funds? For what purposes? Did the endowments grow or decline? Endowment fund annual report? I do not recall formal reports by the post-grad program director to the department. There are opportunities for informal reports at PALM meetings. The academic department meetings are used to transmit information from the Department Head rather than as a decision-making academic body to receive and debate and approve reports from committee chairs.
- Mostly. The HemePath provincial discipline committee is struggling somewhat. Again, we're still finding our way in the new province-wide health authority.
- Difficult to comment with limited experience. The Hematology Discipline Committee has not been particularly effective, but has lacked clear leadership.

e) <u>Are departmental policies and procedures sufficient in number and scope, clear, transparent and regularly communicated</u>?

The Department is committed to three mandates-Clinical Care, Academics and Public Health. As noted in Section 2-Strategic planning-the Department aligns to SHA and COM strategic plans and policies derive from this (please refer to the logos on the front page of this Self Study which emphasize the alignment of COM and SHA Vision, Mission and Values), plans and measures progress by utilization of common **Objectives**, **Key Results** and **Principles** in the domains of *Culture of Safety, Connected Care, Clinical Leadership* and *System Alignment and Integration.*

Section 2 also lists alignment with the COM Strategic Plan 2017-22. The creation of Provincial Specific and Functional Group allows for the implementation of effective provincial planning.

The Department also follows policies for the College of Physicians and Surgeons of Saskatchewan-to do with Clinician competence and professionalism and Laboratory Licensing, and various laboratory accreditation standards as mandated by the Western Canada Diagnostic Accreditation Alliance (WCDAA), College of American Pathologists (CAP), Public Health Agency of Canada (PHAC),National Microbiology Laboratory (NML) Canadian Blood Services (CBS) and American Society for Histocompatibility and Immunogenetics (ASHI)-among others.

As the Department continues to proceed with the integration process more provincial departmental policies are being developed in an evidence based and collaborative manner to do with wide initiatives that apply to professional practice, patient safety and quality and regulatory affairs (please see documentation concerning quality and regulatory affair in Appendix #6). As new policies are implemented, they are communicated widely by means of discussion at various departmental meetings, circulated in department-wide

communications and department members are encouraged to access all by means of Sharepoint.

Comments from faculty:

- According to my experience, our procedures are definitely transparent, clear and are properly communicated.
- Yes – lab disciplines are better than most at policy and document generation and control.
- Unable to comment on the enduring structure. The Pandemic communications have been timely and comprehensive.

f) Is the department's governance structure designed in accordance with its province-wide academic and clinical mandates?

Yes. The department is provincial in culture and structure and is committed to three mandates-clinical care, academic and public health. Examples of commitment to a provincial mandate are proved in Section #2 (Strategic Planning), to Clinical Care in Section #3, to Education and Research in Sections #3 and 4-while the most cogent example of the deep commitment to public health is the response of the Department to the COVID-19 Pandemic.

Comments from faculty:

- The governance structure matches its academic mandate; it is difficult for me to comment on the clinical mandate.
- From the perspective of a staff pathologist, broader representation from sites outside of Saskatoon would be highly beneficial to widen the "lens" from Saskatoon to the province as a whole.
- I consider the governance structure in transition and that it has been in transition for 8 years (from the development of the one-faculty model to creation of the SHA). I think it would be useful to set a target date for complete transition. The overall SHA department clearly has made the medical/scientific staff structure and organization a secondary goal (putting appointment of Directors and Managers first in the initial two-year period and no scheduled date for work on the permanent medical/scientific structure).
- Yes – although the site leads in both Saskatoon and Regina are wearing more hats than is healthy for them.

g) Is each department member's academic and clinical work regularly reviewed by the department head and is career advancement advice and assistance readily available? Is there an established system of performance feedback?

The department Head has tried to meet with faculty once a year-this was feasible before provincial integration-but is becoming increasingly difficult-so hence the need for appointment of Area Leads in Saskatoon and Regina-please see previously. We are currently in the throes of launching an annual review tool for use by Division Heads-with a similar review of Division Heads by the

Provincial Head. Reviews to-date have included discussions around teaching evaluations (residents and medical students), adequacy of clinical practice, career options and support. The department has made great efforts to promote consideration of pathways in education and leadership. Since 2016, two department members have been supported to attend Harvard Macy Courses, and a third is planned for 2021, while two members are exploring the potential for Masters in Education opportunity in U of S. Additional members have been connected with Leadership coaches, or funded to attend leadership courses.

Hires since 2016 have been offered on going mentorship from within or outside the department-many-but not all have availed of this option.

The Department Head meets all USFA Faculty at least twice per year (Assignment of duties and Annual Review) to review resident evaluations. USFA and other faculty have been made aware of promotion criteria and have been mentored though this and extension of probationary status.

Comments from faculty:

- Dr. Magee is always approachable and very interested and supportive. He has not had a chance to do regularly scheduled reviews recently, but has done so in the past. The inability to do this recently may have to do with the fact that he is continuing to work as a local head and provincial head (doing two jobs) and just does not have enough time. There is a system in place to allow feedback.
- The performance of the members is being regularly reviewed, as required. Career advancement advice and assistance are appropriately provided.
- I commend Dr. Magee for starting a process to meet with each faculty member annually for 30-60 minutes. In the past two years we have discussed clinical service. We have not discussed teaching or research or academic committee work. I do not report the hours that I spend teaching residents, preparing for teaching, setting exams or marking because there is no system of collecting or assigning value or recognition for this academic work. I am not aware of any academic promotions in our department in recent years. In my opinion, career advancement is considered and organized for faculty that are in-scope of the faculty association. I am not aware of career advancement processes or discussions for faculty that are engaged by contract or that are SHA out-of-scope staff. There have been questions about using the SHA accountability and performance plan process for medical/scientific staff. Staff are encouraged to complete the paperwork; however, I am not aware of processes to enact salary increases for medical/scientific staff.
- I believe that this happens regularly in Saskatoon, but does not occur with regularity in Regina. This may reflect a number of issues, but the Department Head appears to have many commitments, and greater focus (or appropriate delegation) may be required to enable this work to be done on a provincial scale.

h) Are the department's academic committees, planning processes and other academic administrative affairs consistent with the need for representation from learners, faculty and others associated with distributed medical education sites?

Yes. The department is involved in UGME and PGME education (please see also **Section 4**).

PGME

The Department hosts a General Pathology Residency Program that has three effective committees that deal with post-graduate educational issues

1. Residency Program Committee (RPC)
Membership includes residents and faculty. (a copy of the TOR is included in Appendix #6.)

2. Competency (CBD) Committee
It was necessary to implement this committee as in July 2019-the Residency Program moved to a CBD model-(a copy of TOR and Membership is included in Appendix #6)

3. Resident Selection Committee
Membership changes for each CaRMS though includes Program Director, 1-2 Faculty (Pathologist or Clinician), Chief Resident and Resident representative.

The Residency Program Director (PD) has .25FTE protected time for program duties and there is a dedicated 1.0 FTE CUPE Program Administrative Assistant (PAA) who is based in Saskatoon to support the PD and provides administrative support to the residents and medical students (U of S and out of province) in Saskatoon or other sites. This individual is also responsible for coordinating all resident and medical student activities such as scheduling, rotation development and budgeting etc. Additionally, the Financial Manager (COM), based in Saskatoon participates in program administration to ensure optimum program functioning between the distributed sites.

Planning for PGME involves input from a number of sources including-resident and faculty retreats (two recent departmental retreats have been devoted to CBD-(please see appendix 6-also Section 4). Weekly meetings of PD and PAA, monthly meetings of the RPC and CCC.

In addition, the Department Head meets at least twice a year one-on-one with all of our residents to provide career advice and options-this has results in applications for Fellowship support from RUH Foundation-with subsequent recruitment by means of a 'return of service' contract (Drs. Marilyn Kinloch, Ian Marie Lano and Viktor Skihar)-with plans for 4 more in the next 3 years.

The Department Head reviews all resident teaching evaluations of faculty (USFA and non-USFA) and schedules one-on-one interviews as indicated.

UGME

Historically, the Department has not been overly engaged with UGME as no specific Pathology Course now exists in the UGME curriculum. However, in collaboration with Drs. R Gjevre, A. Selvig and others, the Department is in the process of developing an increasing 'footprint' in UGME by means of developing 'customized short laboratory medicine modules' to follow specific clinical sections-based on the

concept of 'no content without context'- please see Appendix 6.

Comments from faculty:

- The writer's perception (fair or unfair) is that these processes are Saskatoon-focused.
- I do not know how I would obtain information to answer this question.

i) Does the department have mentorship programs for new department members?

Departmental mentorship related to 'transitioning to practice' is an on-going and iterative process. Examples of 'on-boarding checklists' are included in Appendix #6. Mentorship comprises two very different components around a. content expertise and b. career development. While part of on-boarding deals with the challenge of transitioning to practice-the second component consists of detailed discussions with the department head to ascertain competencies and interests in academic and or leadership domains.

On the basis of this, the faculty member is directed to meetings with Vice Deans Education, Research, Faculty Engagement of Faculty Development among other areas. Engagement with the COM Faculty Development Program and/or with the OVDR is encourage. On-going departmental support for new faculty is provided.

Comments from faculty:

- According to my knowledge the mentorship program is in place and I have been requested to serve on a mentorship committee for one of our new faculty.
- Dr. Magee started a mentorship program for new faculty three years ago. It successfully ran prior to creation of the SHA and a new burden of administrative work for him and for other faculty mentors, as well as the new mentees.
- In Saskatoon, I believe so. In Regina, for surgical pathology.

j) What does the department do to develop and support future leaders? Is leadership succession planning actively pursued?

Leadership is a Canmeds role strongly espoused by the department. The department strives to create a safe place to allow for input from all and enhance departmental decision making.

This begins in residency program-we have supported residents to attend leadership courses (i.e. 2-week-long Annual "Emerging Health Leaders Program) supported our chief residents, and ensure resident engagement with entities such as the EB group currently provided expert information for the Pandemic Committee. Staff have been supported to attend leadership in education programs at Harvard Macy, avail of leadership coaches, attend PLI or other leadership courses. Individuals have been recommend for leadership positions in organizations such as Royal College of Surgeons and Physicians of Canada (RCPSC), Canadian Association of Pathologists (CAP), Canadian Partnership Against Cancer (CPAC), Childress Oncology Group (COG) and International Society

for Pre Natal Diagnosis (ISPD) and others.

Leaders in Laboratory Medicine have been regular presenters at departmental rounds (Drs. Beverly Carter, NL, Martin Trotter, UBC, Laurette Geldenhuys, Dalhousie, Mr. Craig Ivany, RORLA, Mr. James Slater, DSM etc.).

Finally-in an effort to promote our own faculty and leaders on a national and international stage-the Department-in collaboration with COM CME- has organized and sponsored two **Choosing Wisely** Conferences in Saskatoon (2008, 2009), will host the **CAP National Conference** in Saskatoon 2021, is planning to host an International Conference of Laboratory Medicine in 2022 and a conference highlighting **Female Leaders in Lab Med** in 2022.

Comments from faculty:

- Ability and encouragement to do leadership training.
- The department has supported some faculty to attend the Saskatchewan Leadership Program and the department also encourages participation in SMA medical leadership programs (for eligible faculty). The College of Medicine and business school programs related to leadership are also locally available.
- Our department members are being actively involved in leading new initiatives and programs in clinical and research areas. These activities catalyse the development of future leaders and are consistently supported by the current Department Head/Provincial Medical Director Laboratory Medicine.
- Coaching is available for some as needed, although a repeated request for coaching for a junior colleague and "mentee" has not yet been accomplished. A formal program of leadership development was underway but seems to have been sidelined in recent months by SHA org change planning at the provincial level. Some of the impediment goes back to item f) – the PH has too much to do, so something has to "give" from time to time. Succession planning is discussed but constrained by multiple factors. An important constraint is the unwillingness (because it is an entirely arbitrary decision) of the new health authority to give full recognition to PhD scientists (about 1/3 of our professional staff) in the form of eligibility for departmental leadership roles.
- The Provincial Head is very active in this regard and works to develop a cadre of leaders. The satellite sites would benefit from a greater focus on talent development and succession planning.

k) <u>Is exceptional performance, whether clinical or academic, recognized, acknowledged or rewarded</u>?

The Department has many avenues to recognize exceptional performance:

1. 'Shout-outs' either in Departmental Meetings or by email to all department members
2. Articles in the Departmental Annual Review (please see Appendix #6)
3. Personal comments at times of 1 on 1 reviews with Department Head
4. Specific prizes for resident research (please see Appendix # 6)
5. Annual Merit Awards for USFA Faculty

Comments from faculty:

- Yes.
- The exceptional performance is properly recognized, consistently acknowledged and rewarded.
- Dr. Magee has organized a departmental report based on voluntary submissions where faculty can be acknowledged. I believe there is a system for in-scope faculty to have their academic work tracked, recognized and rewarded. Faculty that are SHA employees and contractors do not have a system, but the College does send a thank-you certificate within the first year of working for them. There is an opportunity during the annual faculty performance reviews with Dr. Magee to be acknowledged. Each year the department residents select a faculty member for an award in recognition of teaching.
- Again, Saskatoon appears to have moved ahead in this regard. It is not occurring in a transparent, balanced and province-wide manner.
- Acknowledged, yes. Not sure what "rewarded" would look like – "the opportunity to do more" perhaps.

l) Are departmental lines of communication open and effective, including those involving the Provincial Head?

Comments from faculty:

- Yes.
- I think there are reasonably good lines of communication within the department division, between division and with the provincial head.
- Fergall is always excited to try new things and speak to the people about pressing items. I am excited to have him fully embrace this role, when the Saskatoon Area Lead is posted, because I feel he is often spread very thin. Given more time he would excel at relationship building and be able to address all items at a provincial level.
- They were previously quite limited, but the Pandemic response has improved this enormously.

m) Describe the overall culture of the workplace, as identifiably associated with the department.

We hope the Department promotes a culture of safety, life-long learning, respect and a commitment to patient care, academic and public health. The Department is a varied collection of multitalented individuals from at least 16 different cultures from North America, South America, Africa and various parts of Asia and Europe. The potential that can be leveraged from this disparate group is immense and we continually strive to ensure a culture that allows for this We believe in the power of health teams and constantly work to promote inclusivity, transparency and consensus-so that we can learn from all of us.

Comments from faculty:

- Trust and feeling that we are supported. Balance of work life is stressed. Efforts to improve visibility of Department are starting to pay off.

- I think there is a strong sense of pride on the quality and quantity of service work performed by the department by divisions and by individual faculty, considering the limited resources available. I continue to be surprised how much support some faculty offer the College of Medicine and residency training program by volunteering time and effort considering the lack of interest or recognition for work performed by the College. Like most departments we consist of functional divisions of expertise or silos with somewhat loose connections that bind us together as a department. Dr. Magee has tried to foster engagement in faculty by holding meetings or social events after work-hours and he has also organized a faculty retreat. I think these are good ideas.
- Overall the Department operates in a very collegial fashion, collaborations within and across disciplines are encouraged and the diverse nature of the Provincial Program Laboratory Medicine provides ample opportunities for collaborative projects. New initiatives are consistently supported.
- The provincial department has previously made very limited impact on the culture of the Regina workplace. This has changed significantly during the Pandemic response, with greater cooperation, mutual respect and collegiality.
- This is tough – there are many subcultures, highly variable. Provincially, we're quite collegial, open, flexible, innovative and attentive to the wellbeing of one another. There are local pockets wherein that is not true. The PH is aware and trying to address it, but culture is a tough thing to wrestle to the ground!

n) Does the department have a conflict resolution mechanism in place and is it effective?

Yes. We value a culture where opinions are sought and equally valued. Should an impasse arise we seek help from policies, procedures and expertise from SHA and COM. There is zero tolerance for issues of harassment or discrimination. Conflict in UGME or PGME would involve an initial response from our Program Director or Department Head-with involvement of respective Dean as required.

Comments from faculty:

- Yes.
- Not on a provincial basis.
- We have access to resources to help. Effectiveness is, again, highly variable and is related to deeply ingrained subcultures.

o) Is workplace and job satisfaction for departmental staff monitored and are any issues/challenges effectively addressed?

Faculty are engaged through a number of compensation models that govern and guide discussions around workplace and job satisfaction. Discussions with the Department Head around career planning and support occur on a regular basis beginning in our residency program. Formal on-boarding, transition to practice and mentorship is available for new staff-while mentorship of academic careers is offered with great support from the OVDR. Two faculty who have expressed a significant interest in education (Drs. Janine Benoit and Rani Kanthan) have been supported to attend courses at Harvard-Macy. Faculty have been supported to avail of

'micro-fellowship' training in specific subspecialty areas (dermatopathology, gynepathology, pulmonary pathology and next HAL certification). Residents have been guided in elective choices and supported in Fellowship training (gynepathology, dermatopathology, and shortly pediatric pathology). We hope that the departmental culture is one that supports the concept of 'life-long learning'-with an emphasis on career(s) as opposed to job-and a trajectory that has the potential to include-successful transition to practice, development of subspecialist expertise and encouragement and support of assuming leadership roles. All faculty are encouraged to seek academic promotion and are advised of the promotion standards of the COM individually or at Department Meetings. Support to develop promotion portfolios is provide by the Department Head.

Remuneration is an issue of on-going irritation, in particular, the varied mechanism of payment for PhD faculty-please see also Section #1.

Comments from faculty:

- Yes, though intermittently and sometimes done by division heads.
- The workplace satisfaction is monitored by regular individual meetings with the Department Head/Provincial Medical Director Laboratory Medicine. I have not observed any serious issues or challenges.
- Not on a provincial basis. This appears to be improving during the Pandemic response.

p) <u>Is workplace safety actively monitored and are any issues immediately addressed</u>?

The department is governed by the same policies and procedures as SHA and COM with respect to workplace safety. These are widely available online through the intranet, COM website and in documentation distributed though all Laboratory sites. In addition, as a result of the strict culture that exists in laboratory medicine around laboratory licensing and accreditation, the department is governed by additional policies from the College of Physicians and Surgeons of Saskatchewan (Licensing), Western Canadian Diagnostic Accreditation Alliance (WCDAA), College of American Pathologists (CAP), Public Health Agency of Canada (PHAC), National Microbiology Laboratory (NML), Canadian Blood Services (CBS), American Society for Histocompatibility and Immunogenetics (ASHI), *and Canada Nuclear Safety*). The Department possesses a Director of Quality and a separate Director of Regulatory Affairs to oversee and implement policies in these areas.

Events that result in patient of faculty issues are reported through 1600-as critical events and investigated with final report and recommendations addressed to the Provincial Safety Committee, Departmental Rounds, Provincial Executive Committee, Lab Med Provincial Dyad Leadership, Provincial Program Dyad Leadership and the MOH. This is performed in a "how can we learn from this" as opposed to a blame culture. Residents are included in this process.

Comments from faculty:

- Workplace safety is actively and regularly monitored. All issues are immediately and appropriately addressed.
- Yes.
- Yes, very much part of lab culture.

q) Physician/Staff Health and Wellbeing

The Department Head, Executive Director, Division Heads, Directors and all other leadership routinely monitor faculty, staff and residents in terms of health and wellbeing-particularly in times of stress-such as the current Pandemic. If any concerns arise, informal discussions initially occur followed by mentoring and if indicated recommendations to seek professional help (Brenda Sanger, SMA or other similar resource). Wellness is now a standing item on the Departmental Meeting Agenda and will be the topic for discussion at the next faculty and resident Departmental Retreat. This topic has already been discussed at a number of residency educational events.

The Department is in the process of identifying a number of **Wellness Champions.**

Comments from faculty:

- Somewhat. Also delegated to division heads.
- Not able to comment, since my primary activity is in running a research lab.
- Not on a provincial basis. This appears to be improving during the Paandemic response.
- Yes, although being able to address them can be a challenge.

r) Is the current Provincial Head viewed as a good communicator, inspiring leader and strong relationship builder?

Comments from faculty:

- Dr. Fergall Magee's communication style and leadership is to be commended. He seeks out information to help understand situations from all angles to inform him on situations prior to takin any actions. Dr. Magee continually strives to build relationships within the province of Saskatchewan and also nationally/internationally. These relationships help bring new perspectives to our provincial program to strengthen and deliver our service within SHA and build the most current knowledge of CoM Residents.
- Absolutely.
- Yes, the Provincial Medical Director, Laboratory Medicine, is certainly viewed as an excellent communicator, inspiring leader and a very effective relationship builder.
- Yes.
- Yes. Dr. Magee is an extremely inspiring leader, a very strong relationship builder and a very good communicator. He is always very supportive in many aspects. He is always open to feedback.

- Yes, Fergall is an amazing communicator that builds strong relationships amongst team members. He has taken a group of individuals and created a provincial team. Fergall has the ability to look above the day to day work in the lab and provide a worldly perspective to influence the group toward more aspirational goals then they otherwise would have achieved.
- Yes, I think so.

s) To the extent applicable, does the Provincial Head allocate workload or assign duties, whether clinical or academic, in a fair and transparent manner?

Comments from faculty:

- Agree – tasks are provided and allocated with a report back process of timelines. I am unsure of how the information is shared across all for transparency.
- Yes.
- Yes.
- Yes. Dr. Magee delegates tasks and assignments to all his clinical staff. He meets monthly with all clinical staff to ensure all goals are on track and to provide guidance.
- Fergall is collaborative and in my experience allocates work in a fair and transparent manner.
- According to my knowledge and experience, duties within the Department/Provincial Program Laboratory Medicine are being assigned in a very fair and transparent manner.
- Yes, in his home site. Elsewhere, because it is delegated to the area lead, my colleague had difficulty with her direct report in procuring adequate protected time for her TM role, such that she relinquished it altogether.

t) Does the Provincial Head appear to fulfill his/her mandate with respect to the position description and reporting/accountability expectations?

Comments from faculty:

- Agree.
- Yes.
- Yes.
- Yes. Any time that I have needed Fergall's support he makes himself available. He fulfills all of the tasks I would envision being manded in his position and more.
- In my opinion Dr. Magee fulfills his responsibilities and mandates fully. His position is very complicated but Dr. Magee always keeps his provincial and U of S mandates at top of mind to ensure they are discussed locally and provincially.
- Definitely yes, in respect to the aspects I am able to assess based on my duties and experience.
- Yes.
- As far as I can tell.

u) Does the Provincial Head keep department members up-to-date regarding health system and college changes, developments, initiatives and expectations?

Comments from faculty:

- Yes, monthly meetings. Moving to have a provincial focused team has had its challenges but the diligence and perseverance is to be commended for the common goal. Change is hard, but knowing and understanding our goals is key to communication and Fergall does this very well.
- Yes.
- Yes.
- Yes.
- Yes. Fergall is very good at updating the team at regular meetings and calls. With COVID I have found that with all of the changes I am always aware of what is happening, how it will impact my portfolio, and what the expectations are for me moving forward. In this difficult time of constant change that is something to be commended.
- Yes, updates and appropriate explanations are being provided as required.
- Yes.
- Fergall is an excellent communicator, working provincially he is consistently updating all clinical and technical staff on all items that he is working on and developments that are changing. I find Fergall to be one of the best communicators that I have had the privilege to work with.
- Yes.

v) Does the Provincial Head effectively manage communication and relationships with key stakeholders and constituents such as faculty, learners, staff, administrators, other departments, allied health professionals, government representatives and health institutions?

Comments from faculty:

- Yes.
- Yes. Very effectively.
- Fergall is very good at staying in communication with the College of Medicine and the Universities. He is always able to assist with a contact for other Departments or groups when requested to help with an issue or project moving forward. If he does not have a contact, he is always willing to help find a pathway to move things forward.
- Yes, to the best of my knowledge and as all this is related to my professional activities.
- Yes.
- From the SHA perspective, Dr. Magee places communication and relationships as one of his top priorities. All provincial departments meet monthly, Saskatoon leadership meets weekly and he meets with administration daily. In this way plans are communicated or created and then enacted. Fergall works collaboratively with all clinical and administrative staff and ensures they are well informed to make proper decisions.

w) Is the Provincial Head a capable and trusted manager of departmental resources? Are allocation decisions collaboratively discussed? Do they remain consistent with the department's strategic priorities? Are available resources sufficient for fulfilling the departmental mandate?

Comments from faculty:

- Dr. Magee has the patient in mind with all discussions and decisions. All are aligned with provincial strategic planning and priority setting. There is not sufficient resources of HR or financials to meet the provincial program mandate. Every day decisions are made with the resources available. Strategic planning is very difficult with a year-to-year budget allocation and not knowing what will be approved by the Government until at least four months into the next fiscal year. This delay impacts the success of many plans. These factors are totally outside the hands and control of Dr. Magee, who manages them and communicates constraints respectfully with all colleagues and stakeholders.
- Yes to all.
- Yes, very capable and trustable.
- Yes. The OKRs for the Laboratory Department are clearly shared and Fergall aligns his decisions and workload to those priorities. If something comes up that we are unable to move forward, he is great at thinking outside the box and contacting other provincial leaders or contacts to determine a way to go forward working within our constraints.
- Yes, the Provincial Medical Director, Laboratory Medicine, is a very capable manager and all related decisions are appropriately discussed. Additional resources and administrative support would further enhance our performance within clinical and academic/research mandates.
- Yes, decisions are collaboratively discussed and remain consistent with the department's priorities while being appropriately opportunistic when strong talent becomes available. Sometimes "political" constraints limit the flexibility to deploy professional staff optimally. Often, the ability to recruit the needed talent at professional and technical levels in constrained by lack of availability. Excruciatingly prolonged labour negotiations have limited the ability to procure the technical expertise required for lab disciplines.
- The Provincial Head is highly capable. Some of the hiring decisions do feel focused on Saskatoon, but this is the main teaching site for the program. The Provincial Head is limited at other sites by having to work through the ADLs. The Pandemic has severely challenged departmental resources in some areas, but the collaborative approach and response of the government has been heartening.
- Fergall is absolutely a trusted manager of resources, he is very transparent in his decision making, allowing staff to understand the logic behind decisions. All major decisions are discussed collaboratively. Fergall understands the complex nature of laboratory medicine and pathology services and relies on the clinical and administrative expertise within the department. Resources within the department are a constant challenge and decisions need to be made daily as to the priority of work in order to fulfill the departmental mandate. Fergall always places patient care above all else, as resources can be challenging this commitment to patients and can slow other initiatives.

x) Does the Provincial Head feel adequately supported by the Dean's office and the health authority's senior administrators?

Yes. The Provincial Head (PH) meets monthly one-on-one with the Dean of Medicine and attends APPC, PPAC, PH-Dean and (currently) a variety of Pandemic Planning and Response Meetings.

Currently there is no ADL for Saskatoon but the Provincial Head has regular meetings with the ADL (North) and Interim ADL Regina and Rural, the Executive Director and other Directors of Laboratory Medicine, the Provincial

Programs Group and Dyad Leadership (Dr Paul Babyn, Mr. Corey Miller). The Provincial Head receives on-going support. The PH also has regular meetings with the Associate Deans (Research, Education and Faculty Engagement) and the Director of Faculty Development. The PH wishes to acknowledge that he receives significant support rom all of these individuals or groups. We live in times of severe fiscal restraint-which may actually worsen in a post COVID-19 era but we believe that senior leaders are aware of the crucial role of Laboratory Medicine in optimizing patient care and continually advocate on behalf of Laboratory Medicine and the patients we all serve.

Comments by faculty:

- Not always.
- To my knowledge, yes.

Summary from the Provincial Head

I think that readers of this document will conclude that many within Provincial Laboratory Medicine are working hard and effectively to answer the call of the Kendall Report. However, the document also contains frequent and forceful articulations of disengagement and deep distrust with the ***vision*** and ***process***. This may be due, in part, to unhappiness with clinician contracts but the degree of distrust expressed may speak in addition to deeper dissatisfactions.

The Ministry of Health (MOH) is vital to the success of an Integrated Laboratory Practice. While support from the MOH during the COVID-19 Pandemics has been exemplary, interactions over the longer term have been episodic and -*ad-hoc*- whereas engagement in the development of a 10-year strategic plan around human resources and skill sets, implementation of newer technologies and enhanced informatics capacity is required.

Given these factors, despite the abundance of successes listed in this document, the current Provincial Head is unsure what the future holds for this organization - there is significant risk that the ***efforts*** of the many could be subverted by the ***attitudes*** of the few.

Reply to a comment in Departmental Self-Study concerning the Advanced Diagnostic and Research Laboratory (ADRL) - 30 DEC 2020

Drs. Smith and Shaw

I am extremely grateful for this opportunity that you have provided me to respond to an anonymous comment contained in the Departmental Self-Study concerning the ADRL. I am referring to an opinion voiced in Section # 6-Governance, Leadership and Administration on page 148, which stated:

"I am not aware who has legal and fiduciary responsibility for ADRL or why the SHA laboratory services are expected to pay above market prices for laboratory services provided by ADRL"

I became aware of this comment for the first time just before the Self-Study was scheduled to be sent to you both (Friday, May 29th, 2020).

I asked my Administrative Assistant - without revealing the name of the faculty member - whether she could send that individual a message on my behalf to state that this comment was factually incorrect and to ask the faculty member to refer to Section #3-Patient Care Mandate, Provincial Genomics Section, pages 55-59, in which I discussed the extremely effective work of the **Biomarker Development and Quality Assurance Committee,** a group who evaluate and approve the introduction of clinical testing performed by ADRL and in which I also discuss the precarious finances of ADRL. I made this recommendation, as I had hoped that it would provide a more informed appreciation of the challenges faced by ADRL. The subsequent reply by the faculty member to my Administrative Assistant was an emphatic statement to the effect that she/he considered their original comment to be a statement of truth.

Subsequently, I added a final **Summary** to Section #6-page 163, in which I referred *to 'distrust', 'dissatisfactions'* and to the *'significant risk that the efforts of the many could be subverted by the attitudes of the few'.* These comments were primarily intended for the faculty member who had submitted the factually incorrect statement about ADRL.

Following submission of the Self-Study to yourselves, I also had a telephone conversation with Dean Smith, to acknowledge that I realized, as the subject of a Departmental Self-Study, I was not capable of 'airbrushing out' faculty perceptions that I felt were invalid, but I felt obliged to assure him that I was absolutely convinced that the comment was, as I have indicated above, not only factually incorrect but unprofessional and destructive.
I provide this short communication as a rebuttal to that comment and ask that it be added to the Self-Study, to ensure all future readers of that document are aware that I consider that this comment about ADRL, as entirely without merit.

Once again, I wish to thank Drs. Preston Smith and Susan Shaw for this opportunity to reply to this troubling statement.

Dr. Fergall Magee
Provincial Head

Dr. Paul Babyn
Physician Executive, Provincial Programs

Saskatoon City Hospital
701 Queen Street
Saskatoon, SK S7K 0M7
P: 306-655-0073

May 11, 2020

Dear Committee Members,

Re: Dr. Fergall Magee

I am writing to you today to provide my thoughts regarding the work of Dr. Fergall Magee from my perspective of Physician Executive of Provincial Programs, which includes Lab Services. In my opinion, Dr. Magee has served admirably as Provincial Head of the Department of Pathology & Laboratory Medicine, within the Saskatchewan Health Authority's Provincial Programs Portfolio for the past several years. Since his appointment, Dr. Magee has worked diligently on the strengthening and building cohesion and alignment of an excellent team of Physicians and PhD Clinicians across the province. He has worked to ensure there is broadened operational physician and clinician leadership with a strong provincial outlook. He and the team have also worked on the development of a longer-term strategy to improve operations, the functioning of quality improvement and academics.

In reply to the specific questions listed for the completion of this Department Self-Study in Section 6 Governance are as follows:

1. *Is the current Provincial Head viewed as a good communicator, inspiring leader and strong relationship builder?*
   I have found Fergall to be inspiring and an excellent communicator. In the interactions I have seen he has demonstrated that he works well with both his team, operations and other physician colleagues across the SHA.

2. *To the extent applicable, does the Provincial Head allocate workload or assign duties, whether clinical or academic, in a fair and transparent manner?*
   I have minimal knowledge of this other than the use of a Pathology workload points system, which seems to make the work assignment reasonably transparent.

3. *Does the Provincial Head appear to fulfill his/her mandate with respect to the position description and reporting/accountability expectations?*

Dr. Magee provides appropriate feedback and is actively involved in the relevant meetings of Provincial Programs. He provides strong leadership in the strategic directions of the Department and development of an integrated team across the province. He works well with the Executive Director of Lab Services and provides thoughtful input at all the tables he is a participant.

4. *Does the Provincial Head keep department members up-to-date regarding health system and college changes, developments, initiatives and expectations?*

   I cannot answer this from the perspective of a department member but it seems so when I discuss matters with members of his team that he communicates fully.

5. *Does the Provincial Head effectively manage communication and relationships with key stakeholders and constituents such as faculty, learners, staff, administrators, other departments, allied health professionals, government representatives and health institutions?*

   This is one of Dr. Magee's key strengths in my opinion. He shares his passion for the department and vision for the future of pathology and lab services readily. He provides an excellent role model for departmental members, especially the up and coming vibrant team members of Lab Services that currently are working hard administratively and academically.

6. *Is the Provincial Head a capable and trusted manager of departmental resources? Are allocation decisions collaboratively discussed? Do they remain consistent with the department's strategic priorities? Are available resources sufficient for fulfilling the departmental mandate?*

   He is a strong partner of Lenore Howey, Executive Director of Lab Services- together they have been a strong leadership dyad that has worked hard to establish appropriate strategic and operational priorities and ensure that appropriate resources are requested and consistent with the Health Authority and University directions.

In conclusion, I greatly appreciate Dr. Magee's involvement and leadership as Provincial Head. I fully support his continuance in this role given his well-recognized talents and strengths. I certainly hope that he continues in this role and is not recruited elsewhere! If you require any further information, please feel free to contact me directly.

Sincerely Yours,

Dr. Paul Babyn