

Medical Biochemistry Electives for Internal Medicine, Paediatric and other speciality and sub-speciality trainees.

Knowledge about how laboratories function and the range of services offered is an important aspect of medical education. It is also important that practising clinicians understand how to interpret laboratory reports and the limitations of the results. Understanding of the pathophysiology of disease underpins many of the laboratory tests used in routine practice. These laboratory medicine electives are designed to give the learner the opportunity to see the workings of a clinical laboratory and to develop some in depth knowledge of the pathophysiology and investigations in one aspect of medicine that uses the laboratory for biochemical analysis. In addition the laboratory environment provides an excellent opportunity for quality improvement projects, research and reviews of test performance.

Medical biochemistry in Hamilton would like to invite residents to select 2 or 4 week electives based in the laboratory to meet a range of educational objectives. The following table lists the types of electives available.

Topic	Time	Location	Major CaNMEDS	Supervisor
Acid base and renal function	2 weeks	JHCC/SJH/MUMC	Medical expert	PK/ADW/TC/CB/SH
Liver function	2 weeks	JHCC/SJH/MUMC	Medical expert	PK/ADW/TC/CB/SH
Immune Disorders and Laboratory Investigations	2 weeks	HGH	Medical expert	WK
Biochemical genetics	2 weeks	MUMC	Medical expert	MP
Vitamins and Trace elements	2 weeks	HGH	Medical expert	JM
Monitoring drugs and toxicology	2 weeks	HGH	Medical expert	JZ
Endocrine Testing	2 weeks	HGH	Medical Expert	ADW /TC
Heart disease function	2 weeks	JHCC	Medical Expert	PK/ADW
Quality improvement project	2 or 4 weeks	All sites	Scholar	All
Review on use of a test in clinical practice	2 or 4 weeks	All sites	Scholar	All
Clinical laboratory research project	2 or 4 weeks	All	Scholar	All
<i>Others can be developed on request for specific interests.</i>				

Common Laboratory Medicine Objective for all electives

These are designed to give a resident a better understanding of the role of the laboratory and how they should make best use of the laboratory and laboratory staff. These will be associated with all the electives offered.

Topic	How will this training be acquired?	Expected Competencies	Assessment
<ul style="list-style-type: none"> • Introduction to the laboratory • Safety • Staffing • Layout • Sample flow 	The resident will be shown around the laboratory, have a meeting with the safety officer for the required training, have a meeting with the lab manger, and spend time observing the sample flow. This will all happen on the first day of the rotation.	<p>The resident will have an acceptable level of understanding of the laboratory safety regulations.</p> <p>The resident will know the different levels of staff and the responsibilities of each.</p> <p>The resident will be expected to understand the flow of a sample through the laboratory.</p>	<p>The supervisor will evaluate this during the regular meetings with the trainee</p>
<ul style="list-style-type: none"> • Pre analytical issues • Collection • Transit Time • Laboratory 	Reference material for background reading will be provided.	<p>Understand the importance of selecting the correct collection container, the correct time of collection and the appropriate form of transport for samples.</p> <p>Understand the issues related to haemolytic, icteric and lipemic samples.</p>	
<ul style="list-style-type: none"> • Turnaround time • Different analytical processes • Factors that impact on time for analysis 	The resident will spend time discussing this with Technical staff and Professional staff in the laboratory. Reference material for background reading will be provided.	<p>Understand the variety of analytical process in use in the laboratory.</p> <p>Understand the different time frame for each type of analytical process.</p>	
<ul style="list-style-type: none"> • Quality Control and Quality Assurance 	The resident will be expected to observe the daily QC procedure on an analyzer relevant to their rotation. Discuss the application of the QC data. They will also be expected to review the QA data for a number of analytes. Reference material for background reading will be provided.	<p>Understand the concept of total quality management.</p> <p>Understand how the QC data can be used to describe variability in a result.</p>	
<ul style="list-style-type: none"> • Post Analytical • Result reporting • Critical values • Variation • Consulting to users 	The resident will be expected to review a series of results each day and to discuss these with the professional staff. It would be expected that the resident would consult with other residents or staff when unusual results are found.	Understand how to interpret tests appropriate to the rotation.	

Acid/Base and Renal Function

Supervisors: Peter Kavsak, Andrew-Don-Wauchope, Tony Chetty, Cynthia Balion, Stephen Hill

Location: JHCC, SJHH, MUMC: Core Laboratories

Overview:

This elective will allow a resident from another discipline to review the pathophysiology of acid/base and renal systems, and to understand the laboratory techniques that are used in the diagnosis and monitoring of disorders of these systems. It will teach the resident important concepts required to encourage optimal collaboration with the laboratory in the management of these disorders. This elective will particularly benefit residents with an interest in general internal medicine, nephrology, respiratory or intensive care. An overview of Laboratory Medicine will also be provided.

MEDICAL EXPERT

Topic	How will this training be acquired?	Expected Competencies	Assessment
<p>ACID/BASE</p> <p>Review of acid and base physiology.</p> <p>Understand the basics of the methodology of blood gas measurement</p> <ul style="list-style-type: none"> • pH • pCO₂ • pO₂ • calculation of HCO₃ • Tissue oxygenation • Co-oximetry <p>Differences between laboratory-based and point-of-care instruments</p>	<p>This will be self-directed, accompanied by guided discussion with the supervisor.</p> <p>There will be opportunity to observe testing and participate as appropriate.</p> <p>Guided reading and discussion with the supervisor.</p>	<p>Correct interpretation of results of investigations</p> <p>Understand the principles of spectral analysis of Hb</p>	<p>In discussion with the supervisor, the resident will be able to:</p> <p>Confidently interpret blood gas results.</p> <p>Describe the principles of spectral analysis of haemoglobin.</p>
FLUIDS AND ELECTROLYTES		Understand renal physiology.	Describe renal physiology and

Review of renal physiology and function as appropriate to the laboratory			function as it pertains to laboratory analysis.
Understand the basics of the methodology for measurement of: <ul style="list-style-type: none"> • Na • K • Cl • Total CO₂ • Ionized calcium • Osmolality 		Understand the principles, strengths and shortcomings of electrochemical measurement	Describe the basics of electrode-based measurement. Describe the methodology of the tests listed/
Calculation and utility of anion and osmolal gaps		Be able to perform these calculations	The supervisor will evaluate this during the regular meetings with the trainee
Estimation of glomerular filtration <ul style="list-style-type: none"> • eGFR calculations • creatinine clearance • pediatric formulas 		Know when to apply the calculation correctly	

COLLABORATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Critical values Learn the roles of the various team members in the laboratory	Review of appropriate laboratory SOPs, discussion with supervisor Bench observation and discussion with supervisor	Understand the definition of a critical result and the role of the laboratory and clinical services in transmitting and receiving the results. Understand what information and assistance is available from which team member.	The supervisor will evaluate this during the regular meetings with the trainee

MANAGER (M)

Topic	How will this training be acquired?	Expected Competencies	Assessment
The role of the laboratory in supporting critical care testing Organization of the laboratory to provide results at the appropriate time	Discussion with the supervisor	Understand the laboratory's role in providing results in a time frame appropriate for good clinical care.	The supervisor will evaluate this during the regular meetings with the trainee

HEALTH ADVOCATE

Topic	How will this training be acquired?	Expected Competencies	Assessment
Appropriate test utilization and selection On-call consultation regarding test approval and timing of measurement.	Discussion with supervisor and review of clinical practices	Appropriate test selection and priority for the clinical situation	The supervisor will evaluate this during the regular meetings with the trainee

PROFESSIONAL

Topic	How will this training be acquired?	Expected Competencies	Assessment
Ethics of add-on tests not ordered by the MRP. Managing time and resources in a non-clinical setting	Discussion and review of materials from CMPA, OMA and professional laboratory societies.	Know when it is appropriate to orders add-on tests, and by whom. Demonstrate professional behaviour in interactions with laboratory staff.	In discussion with the supervisor, describe the rules and processes of add-on tests. Observations from other staff

Liver Testing

Supervisors: Peter Kavsak, Andrew-Don-Wauchope, Tony Chetty, Cynthia Balion, Stephen Hill

Location: JHCC, SJHH, MUMC: Core Laboratories

Overview:

This elective will allow a resident from another discipline to review the pathophysiology of the liver, and to understand the laboratory techniques that are used in the diagnosis and monitoring of disorders of the liver. It will teach the resident important concepts required to encourage optimal collaboration with the laboratory in the management of these disorders. This elective will particularly benefit residents with an interest in general internal medicine, gastroenterology or hepatology. A brief overview of Laboratory Medicine will also be provided.

MEDICAL EXPERT

Topic	How will this training be acquired?	Expected Competencies	Assessment
Tests assessing liver function <ul style="list-style-type: none"> • Transaminases • Albumin • INR • Alkaline Phosphatase • Bilirubin • GGT • Ammonia • Alpha fetoprotein • LDH 	This will be self-directed with guidance from the supervisor.	Correct interpretation of results of investigations and monitoring therapy. <ul style="list-style-type: none"> • Approach to the asymptomatic/symptomatic patient with mild/moderate/severe transaminase elevation • Approach to the patient with an ALP elevation out of proportion to the transaminase elevation • Approach to the patient with an isolated elevation of ALP • Approach to the patient with Jaundice • Acute and chronic viral hepatitis • Alcoholic liver disease • Ischaemic hepatitis 	In discussion with the supervisor the resident will be able to accurately describe the different conditions related to abnormal liver function tests.
<ul style="list-style-type: none"> • Principals of enzyme analysis • Principals of specific protein 		Hereditary conditions <ul style="list-style-type: none"> • Alpha 1 anti-trypsin deficiency • Hemochromatosis • Wilsons disease 	In discussion with the supervisor the resident will be able to describe the different analytical

analysis		<ul style="list-style-type: none"> • Autoimmune hepatitis • Primary Biliary cirrhosis <p>Appropriate utilization of laboratory tests to assess liver integrity</p> <p>Know the information that is available from quality control and proficiency testing and how this enables optimal interpretation of clinical results.</p>	techniques used to determine liver tests and the basic principles of each technique.
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COLLABORATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Learn how the laboratory team members function together	During laboratory bench observation times and in discussion with supervisor	Identify the team member who is best placed to assist with laboratory questions.	The supervisor will evaluate this during the regular meetings with the trainee

MANAGER (M)

Topic	How will this training be acquired?	Expected Competencies	Assessment
The role of the laboratory in the hospital system	In discussion with the supervisor.	Know how laboratory testing is funded and provided in Ontario. Become familiar with the costs of certain tests	The supervisor will evaluate this during the regular meetings with the trainee

HEALTH ADVOCATE

Topic	How will this training be acquired?	Expected Competencies	Assessment
Accessibility to specialized testing How to improve laboratory diagnosis of NASH and cirrhosis	In discussion with the supervisor and reference to the laboratory test information guides available from different laboratories.	Understand the need for specialized testing and the need for assisting individuals with making the correct diagnosis. Be able to determine if a test is a suitable screening test.	The supervisor will evaluate this during the regular meetings with the trainee

PROFESSIONAL

Topic	How will this training be acquired?	Expected Competencies	Assessment
Patient Data-Privacy and confidentiality issues. Ethics of related to providing advice on specialized tests and adding on tests not ordered by the MRP. Managing time and maintaining excellence in a non-clinical setting	Material from the CMLPA, OMA and professional laboratory associations. Participation in meetings, rounds and bench assignments.	Know when the laboratory staff can get involved in test ordering. Demonstrate professionalism in all contact with non-clinical staff.	The supervisor will evaluate this during the regular meetings with the trainee. Observations from other staff.

Immune Disorders and Laboratory Investigations

Supervisors: Waliul Khan

Location: Hamilton General Hospital: Clinical Chemistry & Immunology Section

Overview:

This elective will allow a resident from another discipline to understand the pathogenesis and pathophysiology of autoimmune disorders, immunodeficiency disorders and allergic disorders in detail, and understand the laboratory techniques applied in the diagnosis and monitoring of these disorders. It will teach the resident important concepts required to encourage optimal collaboration with the laboratory to aid in the diagnosis and follow-up of patients with these disorders. This elective will particularly benefit residents with an interest in general internal medicine, rheumatology, or immunology and allergy. A brief overview of Laboratory Medicine is also provided.

MEDICAL EXPERT

Topic	How will this training be acquired?	Expected Competencies	Assessment
Autoimmune disorders <ul style="list-style-type: none">• Rheumatoid Arthritis• Systemic Lupus Erythematosus• Sjogren's Syndrome• Scleroderma• Mixed Connective Tissue Disease• Vasculitis• Celiac Disease• Autoimmune Hepatitis• Paraneoplastic Syndrome• Immunodeficiency• Allergic diseases	This will be self-directed with guidance from the supervisor.	Understand autoimmunity, immunodeficiency and allergy. Correct interpretation of results of investigations and monitoring therapy. Select the correct dynamic function tests to support the presumed diagnosis. Interpreting the tests in light of the clinical context.	In discussion with the supervisor the resident will to accurately describe autoimmune disorders, immunodeficiency disorders and allergic disorders.

<p>Analytic methods</p> <ul style="list-style-type: none"> • Immunoassay: competitive, non-competitive, antibody specificity, avidity, affinity, interferences with immunoassay, multiplexing • Flow Cytometry • Immunofluorescence 		<p>Understand the basic principles of immunoassay, flow cytometry and Immunofluorescence testing.</p> <p>Know the information that is available from quality control and proficiency testing and how this enables optimal interpretation of clinical results.</p>	<p>In discussion with the supervisor the resident will describe different analytical techniques used in tests for autoimmune disorders, immunodeficiency disorders and allergic disorders and the basic principles of each technique.</p>
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COLLABORATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Learn the role of the different team members in the laboratory.	During laboratory bench observation times and in discussion with supervisor.	Identify the team member who is best placed to assist with laboratory questions.	Observations from other members of staff.

HEALTH ADVOCATE

Topic	How will this training be acquired?	Expected Competencies	Assessment
Accessibility to specialized testing	In discussion with the supervisor and reference to the laboratory test	Understand the need for specialized testing and the need for assisting individuals with making the correct diagnosis	The supervisor will evaluate this during the regular meetings with the trainee

PROFESSIONAL

Topic	How will this training be acquired?	Expected Competencies	Assessment
Ethics of related to providing advice on specialized tests and adding on tests not ordered by the MRP.	Material from the CMPA, OMA and professional laboratory associations.	Know when the laboratory staff can get involved in test ordering.	The supervisor will evaluate this during the regular meetings with the trainee.

Biochemical Genetics and Metabolics

Supervisor: Murray Potter

Location: McMaster University medical Centre: Biochemical genetics laboratory

Overview:

This is where your undergraduate biochemistry comes to life! All those pathways are actually directly clinically relevant to inherited metabolic disorders. Don't worry, however, if genetics is not your forte or if a biochemical pathway makes you cringe – this elective gives you some general approaches to inherited metabolic disorders. They are uncommon causes of adult onset diseases, but are important to diagnose because specific therapy is required to properly treat the conditions. As well, improved treatment of pediatric onset inherited metabolic diseases has led to increased survival into adulthood. These adult patients often have complex metabolic care and monitoring and often require general internist or adult specialist care in addition to metabolic follow-up. This elective introduces analytical and clinical biochemical genetics to residents.

MEDICAL EXPERT

Topic	How will this training be acquired?	Expected Competencies	Assessment
Biochemical genetics laboratory tests	The resident will spend time in the laboratory observing common metabolic tests (amino acids, organic acids, acylcarnitines).	<ul style="list-style-type: none">• Biochemical consequences of a primary enzyme block in a metabolic pathway.• General awareness of some common metabolic pathways / defects of amino acid, fatty acid oxidation, organic acid, and urea cycle disorders.• Instrumentation: Basic understanding of how chromatography and mass spectrometry differ from routine analyses.	Given appropriate reference materials (metabolic pathways), the resident will interpret abnormal laboratory data to identify the metabolic block and likely enzyme deficiency.
Inherited Metabolic Disorders: Presentation, diagnosis and management of common chemical pathology	The resident will spend at least 2 half days in the metabolic clinic.	<ul style="list-style-type: none">• Clinical consequences of a primary enzyme block in a metabolic pathway and the way in which clinical and pathological signs may be produced.• Principles of screening	Explain metabolic significance of hyperammonaemia, hypoglycaemia, and metabolic acidosis.

disorders		<ul style="list-style-type: none"> Investigations: Understand how common chemical tests can indicate a potential metabolic disorder, be aware of the clinical utility of metabolic screening tests. 	Explain metabolic differential of neuropsychiatric disease.
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COMMUNICATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Genetic counselling	The resident will attend a genetic counselling session for a positive newborn screen.	Be able to communicate (to patient): what a genetic disease is, what is the difference between screening and diagnostic results	The supervisor will evaluate this during the clinic.
Communication of results	The resident may be required to contact other healthcare providers with clinically actionable results	Recognize urgent / actionable result and communicate to healthcare provider	The supervisor will evaluate this during the regular meetings with the trainee.

COLLABORATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Multidisciplinary team	Biochemical genetics laboratory and metabolic clinic experiences	Understand the roles of the multidisciplinary team in the diagnosis, counselling and management of metabolic disorders. Understands the roles of the multidisciplinary team in the operation of the laboratory.	Discussion with members of the team that have interacted with the resident

HEALTH ADVOCATE

Topic	How will this training be acquired?	Expected Competencies	Assessment
Population screening	Follow at least one positive newborn screening case (laboratory and clinical)	Newborn screening programs	Describe Ontario's newborn screening program

SCHOLAR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Research trials	Discussion with Dr. Potter / Dr. Kozenko	Be familiar with level of evidence and clinical trials for metabolic disorders	Describe the limitations of traditional assessment methods for rare diseases

Vitamin and Trace Metal Elective

Supervisor: Joseph Macri

Location: Hamilton General Hospital: Department of Laboratory Medicine: Clinical Chemistry and Immunology

Overview:

This elective will allow the resident to understand vitamin and trace metal testing from both an analytical and clinical perspective. Residents with an interest in TPN or malabsorption syndromes will benefit from this rotation. The resident will have the opportunity to observe and participate in all aspects of analytical testing as well as review test results from clinical cases. The resident can review in detail the pathophysiology of malabsorption and nutritional support. Upon completion, the individual is expected to acquire a solid understanding of the current state of vitamin and trace metals testing.

MEDICAL EXPERT

Topic	How will this training be acquired?	Expected Competencies	Assessment
Medical The utilization of vitamins and trace metal (TM) testing in clinical areas including: Nutrition, TPN, Bariatric surgery, Toxicology and Renal Disease.	This will be self-directed with guidance from the supervisor.	Understanding of medical guidelines, diagnostic algorithms and treatment protocols used in conjunction with TM and vitamin testing	Oral presentation and discussion with supervisor
Analytic methods Liquid Chromatography, Atomic Absorption, ICP-OES. ICP-MS, HR-ICP-MS Immunoassay enzymatic and colourimetric assays	Guidance from supervisor Observation of technical staff Analysis of samples under direction of supervisor	Understanding of the theory of analytical platforms and their respective advantages and disadvantages. Basic knowledge of the methods used to analyze samples for TM and/or vitamins	Observation by supervisor and oral discussion session
Pre-analytical Preparation Proper preparation of biological	Self-directed with supervisor guidance	Understanding the crucial requirement for proper sample	Oral discussion with supervisor

fluid for TM and vitamin analysis	Review of current laboratory guidelines	preparation with respect to analyte stability and sample contamination	
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COMMUNICATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Ability to discuss TM and Vitamin testing from a pre-analytical, analytical and clinical perspective.	This will be self-directed with guidance from the supervisor.	Ability to communicate effectively with clinical colleagues, laboratory staff and patients.	Feedback from laboratory staff that have interacted with the resident.

COLLABORATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Learn to work effectively as part of a Laboratory Diagnostic team	Participation in all aspects of Vitamin and TM testing <ul style="list-style-type: none"> • Pre-analytical • Analytical • Post-analytical 	Ability to work effectively within a laboratory team Understanding individual responsibilities.	Feedback from laboratory staff that have interacted with the resident

MANAGER (M)

Topic	How will this training be acquired?	Expected Competencies	Assessment
The role of the professional and/or manager in the testing of TM and Vitamins.	Observation and discussion with supervisor.	Understand the cost associated with: <ul style="list-style-type: none"> • Maintaining service • Initiating service 	Discussion with supervisor

HEALTH ADVOCATE

Topic	How will this training be acquired?	Expected Competencies	Assessment
The importance of access to Vitamin and TM testing for the community.	Review of testing practices from different health care and research institutes.	Understand the appropriate ordering and utilization of Vitamin and TM tests.	Review of medical charts and discussion with supervisor.

SCHOLAR

Topic	How will this training be acquired?	Expected Competencies	Assessment
The current state of Vitamin and TM testing as well as future direction	Review of current guidelines and literature review	<ul style="list-style-type: none">• Understand the rationale behind current testing recommendation• Understand how testing with likely change in the future based on clinical evidence and evolving technology.	Discussion with supervisor.

PROFESSIONAL

Topic	How will this training be acquired?	Expected Competencies	Assessment
Patient Data-Privacy and confidentiality issues. Appropriate interaction with laboratory and clinical staff	Participation in meetings, rounds and interaction with laboratory and clinical staff	Demonstrate professionalism in all contact with clinical and laboratory staff	Observation of performance during the course of the elective.

Toxicology and Therapeutic Drug Management

Supervisor: Johannes Zeidler

Hamilton General Hospital: Clinical Chemistry and Immunology

Overview:

The dose makes the poison - and the medicine. The “pharmakon” is a remedy and a cause of illness. This elective for residents from all specialties is an introduction to clinical toxicology, the science of measuring drugs and other chemicals in bodily fluids to assist patient care, in emergency medicine and beyond. The elective also cover the measurement of medications for therapeutic drug monitoring. It can be tailored to meet the needs of each resident.

MEDICAL EXPERT

Topic	How will this training be acquired?	Expected Competencies	Assessment
Principles of sample preparation, chromatography and mass spectrometry	Self-directed with guidance from the supervisor. Shadowing of laboratory staff. Experience of troubleshooting of tests including pre-analytical, analytical and post-analytical phases.	Appreciation of chromatographic methods vs analyser based tests. Ability to use toxicology services efficiently.	Discussion, observation and oral feedback.
Pharmakokinetics (PK) Pharmacodynamics (PD) Pharmacogenetics (PG) Therapeutic Drug Management and Monitoring (TDM) Toxicology	Discussion of clinical cases and connected laboratory issues. Opportunity to attend Ontario Poison Centre Rounds on Fridays in Toronto.	Understand when volume of distribution and clearance change and how they affect half-lives. Ability to adjust doses based on pharmacokinetic principles. Understand what tests to order for differential diagnosis of metabolic acidosis. Ability to recognize and treat toxidromes. Understand laboratory investigations of the unconscious patient.	Discussion, observation and oral feedback.
Forensic Pathology Forensic Toxicology	Discussion of clinical cases and connected laboratory issues.	Ability to interpret urine tests for unauthorized drugs and medication	Discussion, observation and oral feedback.

Forensic Psychiatry Pain Medicine		adherence. Predict effects of post-mortem changes on the results of laboratory investigations. Appreciate medico-legal aspects, understand different meanings of “forensic” in different contexts.	
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COLLABORATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Role of the different team members in the laboratory.	Discussion with supervisor.	Identify the team member who is best placed to assist with laboratory questions and approach them correctly.	Discussion and observation of interaction with technologist oral feedback.
Risks and benefits of drugs and poisons	Self-directed in discussion with supervisor	Advise on toxicology issues	Discussion, observation and oral feedback.

MANAGER (M)

Topic	How will this training be acquired?	Expected Competencies	Assessment
Toxicological lab services for different clinical departments and the community	Review of guidelines and quality management processes. Discussion with supervisor.	Appreciate elements of planning, economics, implementation and discontinuation of lab tests.	Oral feedback

HEALTH ADVOCATE

Topic	How will this training be acquired?	Expected Competencies	Assessment
Adverse drug effects, common and emerging poisonings, herbs, supplements.	Discussion with supervisor	Ability to advise on alternative medicines	Oral feedback

PROFESSIONAL

Topic	How will this training be acquired?	Expected Competencies	Assessment
Ethics of drug testing, including point-of-care testing.	Discussion with supervisor	Ability to weigh and balance autonomy, non-maleficence, beneficence and justice related to toxicology testing. Demonstrate non-judgmental approach to issues of privacy, confidentiality, stigma, curiosity and profit driven testing.	Oral feedback

Endocrinology Laboratory Elective

Supervisor: Andrew Don-Wauchope, Tony Chetty

Location: Hamilton General Hospital: Chemistry Immunology section

Overview:

This elective will allow a resident from another discipline to review the pathophysiology of the endocrine system in detail and understand the laboratory techniques applied to hormones used in the diagnosis and monitoring of endocrine disease. It will teach the resident important concepts required to encourage optimal collaboration with the laboratory to aid in the diagnosis and follow-up of patients with endocrine disorders. This elective will particularly benefit residents with an interest in general internal medicine or endocrinology. A brief overview of Laboratory Medicine is also provided.

MEDICAL EXPERT

Topic	How will this training be acquired?	Expected Competencies	Assessment
<p>Pituitary</p> <ul style="list-style-type: none"> •acromegaly and dwarfism •prolactinoma/macroprolactin • diabetes insipidus • dynamic function testing • isolated hormone deficiency and panhypopituitarism <p>Adrenal cortex</p> <ul style="list-style-type: none"> • steroid production • Cushing's syndrome • insufficiency: assessment of reserve • hyperaldosteronism • congenital adrenal hyperplasia • dynamic function testing <p>Adrenal medulla</p>	<p>This will be self-directed with guidance from the supervisor.</p>	<p>Correct interpretation of results of investigations and monitoring therapy.</p> <p>Appreciation of the role of diagnostic imaging.</p> <p>Select the correct dynamic function tests to support the presumed diagnosis.</p> <p>Provide the appropriate monitoring of hormone replacement therapy</p> <p>Interpreting the tests in light of the clinical context, circadian and other rhythms, and drug interference</p>	<p>In discussion with the supervisor, the resident will be able to:</p> <ul style="list-style-type: none"> • accurately describe the different endocrine conditions.

<ul style="list-style-type: none"> • catecholamine metabolism • pheochromocytoma • measurement and interpretation of catecholamines and metabolites <p>Thyroid</p> <ul style="list-style-type: none"> • congenital hypothyroidism and screening programmes • hypo- and hyper-thyroidism • autoimmune disease, autoantibodies • adenoma • medullary carcinoma of the thyroid • radioactive iodine <i>in vivo</i> studies • investigation and monitoring therapy • problems of interpretation: binding proteins, drug effects, sick euthyroid syndrome 			
<p>Analytic methods</p> <p>Immunoassay, competitive, non-competitive, antibody specificity, interferences with immunoassay.</p> <p>Chromatography, principals and application to laboratory medicine</p> <p>Mass-spectroscopy, principals and application to laboratory medicine, advantages and disadvantages for the range of hormone assays.</p>		<p>Know the range of analytical methods used to analyse the hormones.</p> <p>Know the information that is available from quality control and proficiency testing and how this enables optimal interpretation of clinical results.</p>	<p>In discussion with the supervisor, the resident will be able to:</p> <ul style="list-style-type: none"> • describe the different analytical techniques used to determine endocrine tests and the basic principles of each technique.

COLLABORATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Learn the role of the different team members in the laboratory.	During laboratory bench observation times and in discussion with supervisor.	Identify the team member who is best placed to assist with laboratory questions.	Observations from other members of staff.

MANAGER (M)

Topic	How will this training be acquired?	Expected Competencies	Assessment
The role of the laboratory in the hospital system	In discussion with the supervisor.	Know how laboratory testing is funded and provided in Ontario.	The supervisor will evaluate this during the regular meetings with the trainee

HEALTH ADVOCATE

Topic	How will this training be acquired?	Expected Competencies	Assessment
Accessibility to specialized testing	In discussion with the supervisor and reference to the laboratory test information guides available from different laboratories.	Understand the need for specialized testing and the need for assisting individuals with making the correct diagnosis. Be able to determine if a test is a suitable screening test.	The supervisor will evaluate this during the regular meetings with the trainee

PROFESSIONAL

Topic	How will this training be acquired?	Expected Competencies	Assessment
Patient Data-Privacy and confidentiality issues.	Material from the CMPA, OMA and professional laboratory associations.	Know when the laboratory staff can get involved in test ordering.	Participate in a professional manner throughout the elective. Complete tasks and activities in a timely manner.
Ethics of related to providing advice on specialized tests and adding on tests not ordered by the MRP.	Participation in meetings, rounds and bench assignments.	Demonstrate professionalism in all contact with non-clinical staff.	
Managing time and maintaining excellence in a non-clinical setting			

Heart disease & function

Supervisor: Peter Kavsak

Location: JHCC core laboratory

Overview:

Laboratory testing is important for primary and secondary cardiovascular disease (CVD) care as well as in the acute setting (e.g., myocardial infarction). This elective will review the analytical and clinical utility of clinical chemistry tests that are used to assess heart health. It will allow the resident an opportunity to study the pathophysiology of a number of common cardiac diseases in detail.

MEDICAL EXPERT

Topic	How will this training be acquired?	Expected Competencies	Assessment
<ul style="list-style-type: none">• Atheroma, coronary heart disease, stroke and associated risk factors.• Current methods of calculating risk and their shortcomings.• Use of biochemical markers for risk stratification in acute coronary syndromes.• Biochemical markers of myocardial damage, ventricular function, inflammation, vascular, and renal injury with respect to both acute and chronic cardiovascular disease• Analytical principles used in the measurement of cardiovascular markers.• Primary and secondary cardiovascular disease prevention.• Laboratory investigations and principles of management of hyperlipidaemia.	<p>This will be self-directed with guidance from the supervisor.</p>	<ul style="list-style-type: none">• Advise appropriately on estimation of cardiovascular risk.• Understanding of the appropriate cut-offs for diagnosis vs. prognosis• Advise on the investigation and management of hyperlipidaemia, identification of patients with secondary causes, screening family members in case of familial dyslipidaemia• Understand the role of national and international organizations in establishing diagnostic and treatment guidelines.• Understand the need for, and role of, standardized measurement of lipids and lipoproteins.	<p>In discussion with the supervisor, the resident will be able to:</p> <ul style="list-style-type: none">• accurately describe the different CVD conditions (acute vs. chronic).• describe the different analytical techniques used to determine tests related to CVD and the basic principals of each technique.

COLLABORATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Learn the role of the different team members in the laboratory.	During laboratory bench observation times and in discussion with supervisor.	Identify the team member who is best placed to assist with laboratory questions.	Observations from other members of staff.

MANAGER (M)

Topic	How will this training be acquired?	Expected Competencies	Assessment
The role of the laboratory in the hospital system	In discussion with the supervisor.	Know how laboratory testing is funded and provided in Ontario.	The supervisor will evaluate this during the regular meetings with the trainee

HEALTH ADVOCATE

Topic	How will this training be acquired?	Expected Competencies	Assessment
Accessibility to specialized testing. Importance of access to standardized results for risk calculation	In discussion with the supervisor and reference to the laboratory test information guides available from different laboratories.	Understand the need for specialized testing and the need for assisting individuals with making the correct diagnosis. Be able to determine if a test is a suitable screening test.	The supervisor will evaluate this during the regular meetings with the trainee

PROFESSIONAL

Topic	How will this training be acquired?	Expected Competencies	Assessment
Patient Data-Privacy and confidentiality issues.	Material from the CMPA, OMA and professional laboratory associations.	Know when the laboratory staff can get involved in test ordering.	Participate in a professional manner throughout the elective.
Ethics of related to providing	Participation in meetings, rounds	Demonstrate professionalism in all	

<p>advice on specialized tests and adding on tests not ordered by the MRP.</p> <p>Managing time and maintaining excellence in a non-clinical setting</p>	<p>and bench assignments.</p>	<p>contact with non-clinical staff.</p>	<p>Complete tasks and activities in a timely manner</p>
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Quality Improvement Project

Supervisor: any laboratory associated faculty

Location: All hospital laboratories

Overview:

Quality improvement projects that involve laboratory tests are excellent for the quality improvement projects required for residency training. These can be done to demonstrate the need for a change in test ordering, interpretation or process that can improve defined patient important outcomes. A number of these projects have been recognized with the PGME award for quality improvement.

The rotation would be a formal 2 week rotation where the bulk of the work would be conducted. There is preparation that is required for these projects and thus some time ahead of the rotation a proposal, REB and data request needs to be submitted.

Planning: Choose a topic and a laboratory professional to help you. (3 months ahead); prepare proposal and REB exemption forms (2 months ahead); submit data request (2 months ahead)

MEDICAL EXPERT

Topic	How will this training be acquired?	Expected Competencies	Assessment
Detailed knowledge in area of the quality improvement project	Critical appraisal of clinical practice guideline and or the evidence for the project proposal.	Write a proposal	Acceptance of project protocol.

COLLABORATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Working with laboratory staff	Discussion with laboratory supervisor	Ability to work with all laboratory staff that have a role in the project	Multiple assessments from team members.

MANAGER (M)

Topic	How will this training be acquired?	Expected Competencies	Assessment
The role of quality	Web based tutorials	Ability to organize a quality improvement	Project report

improvement in hospitals and health care.		project.	
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HEALTH ADVOCATE

Topic	How will this training be acquired?	Expected Competencies	Assessment
The role of evidence based practice in health care.	Discussion with supervisor and reading literature on guideline development and sources of best practice information.	Ability to rate evidence and its applicability to the local community.	Project protocol.

SCHOLAR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Difference between quality improvement projects and research. Design a quality improvement project.	Web based tutorials and discussion with supervisor	Ability to design a quality improvement project including all aspects of the cycle/spiral of improvement.	Project protocol.

PROFESSIONAL

Topic	How will this training be acquired?	Expected Competencies	Assessment
Ethical considerations of quality improvement projects	Web based tutorials and discussion with supervisor	Ability to complete an REB application for a CQI	REB application or documentation of REB waiver.

Review on use of a test in clinical practice

Supervisor: any laboratory associated faculty

Location: All hospital laboratories

Overview:

Many specialities use a range of tests in practice for diagnosis, screening and monitoring of treatment. There is often a lack of evidence to support the use of these tests in clinical practice. This elective would allow a resident the opportunity to evaluate a test in detail.

The rotation would be a formal 2 week rotation where the bulk of the work would be conducted. There is preparation that is required for these projects and thus some time ahead of the rotation a question needs to be proposed in the PICO format. A literature search should be conducted to establish the current level of knowledge.

Planning: Choose a topic and a laboratory professional to help you. (3 months ahead); prepare proposal and PICO statement (2 months ahead); library search (1 month ahead)

MEDICAL EXPERT

Topic	How will this training be acquired?	Expected Competencies	Assessment
Detailed knowledge for the topic under consideration.	Self-guided	Write a proposal	Acceptance of project protocol.
Develop PICO question.	Supervisor will guide this step.	Valid PICO question for laboratory test	Project protocol.

COLLABORATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Working with laboratory staff	Discussion with laboratory supervisor	Ability to work with all project team members	Multiple assessments from team members.

MANAGER (M)

Topic	How will this training be acquired?	Expected Competencies	Assessment
The role of evidence	Self-study with guidance from	Ability to use evidence to form practice.	In discussion with

based laboratory medicine in health care.	supervisor		supervisor.
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HEALTH ADVOCATE

Topic	How will this training be acquired?	Expected Competencies	Assessment
The role of evidence based practice in health care.	Discussion with supervisor and reading literature on guideline development and sources of best practice information.	Ability to rate evidence and its applicability to the local community.	Project protocol.

SCHOLAR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Using evidence based practice tools for evaluating primary papers and clinical practice guidelines.	Self-study with guidance from supervisor	Ability to design a systematic review project for a laboratory test.	Project protocol. Project report.

Laboratory Research Elective

Supervisor: Any appropriate faculty member (co-ordinated by Guillaume Pare)

Location: Hamilton General Hospital: Research Laboratory section or other appropriate site.

Overview:

This elective will allow a resident to familiarize him/herself with clinical laboratory research. It will teach the resident important research concepts such as hypothesis testing, evidence-based laboratory medicine, laboratory statistics and bioinformatics. The overarching aim is for the resident to be able to design laboratory research questions and experiments, and critically appraise contemporary literature.

The rotation would be a formal 4 week rotation where the bulk of the work would be conducted. There is preparation that is required for these projects and thus some time ahead of the rotation a proposal, REB and data request needs to be submitted.

Planning: Choose a topic and a laboratory professional to help you. (3 months ahead); prepare proposal and REB exemption forms (2 months ahead); research plan (2 months ahead).

MEDICAL EXPERT

Topic	How will this training be acquired?	Expected Competencies	Assessment
<p>Type of research Expertise will depend on the research project the resident and supervisor will mutually agree on.</p> <p>Examples are early coronary artery disease genetics, genetics of complex traits, novel biomarkers, multiplex biomarkers panel, acute stroke biomarkers, etc.</p> <p>Analytic methods Techniques will depend of the selected project. Examples are:</p>	<p>This will be self-directed with guidance from the supervisor.</p>	<p>General knowledge of methods applied in the research project and their clinical and research applications. Expert knowledge relevant to the medical condition being researched.</p>	<p>Laboratory report, presentation at laboratory meeting and/or residents rounds.</p>

Next-generation sequencing Bioinformatics DNA methylation analysis Gene expression analysis Genotyping Systematic review			
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COMMUNICATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Ability to present a research project.	Presentation at laboratory meeting and writing of research report.	Ability to clearly and concisely summarize a research project, including introduction, hypothesis, methods, results and discussion.	Laboratory report, presentation at laboratory meeting and/or residents rounds.

COLLABORATOR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Learn to work effectively in a multi-disciplinary research environment	By working in a multi-disciplinary research environment.	Identify the team member who is best placed to assist with laboratory questions. Assist other laboratory members in an effective and courteous manner.	Successful completion of collaborative projects.

MANAGER (M)

Topic	How will this training be acquired?	Expected Competencies	Assessment
Understanding of the role of a Principal Investigator in a research project.	In discussion with the supervisor.	Familiarity with financial aspects of research projects as well as administrative components (e.g. ethics, informed consent, etc.)	Project management and discussion with the supervisor.

HEALTH ADVOCATE

Topic	How will this training be acquired?	Expected Competencies	Assessment
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Understand the importance of clinical and basic research for patient care in an academic center.	Participation in clinical work and/or analysis of samples from patients.	Identifies and correctly describes the translational potential of projects.	Laboratory meeting and research presentation.
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SCHOLAR

Topic	How will this training be acquired?	Expected Competencies	Assessment
Understand the scientific method as it relates to laboratory medicine research, including formulation of research question, hypothesis, methods, results and discussion.	This will be self-directed with guidance from the supervisor.	Ability to design and complete a research project.	Laboratory report, presentation at laboratory meeting and/or residents rounds.

PROFESSIONAL

Topic	How will this training be acquired?	Expected Competencies	Assessment
<p>Patient Data-Privacy and confidentiality issues.</p> <p>Ethics of related to research and providing advice on specialized tests.</p> <p>Managing time and maintaining excellence in a non-clinical setting</p>	Participation in meetings, rounds and bench assignments.	Demonstrate professionalism in all contact with clinical and research staff.	<p>Participate in a professional manner throughout the elective.</p> <p>Complete tasks and activities in a timely manner.</p>