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University of Toronto Neuropathology Residency Program - Outline

Program Contact  Dr. Julia Keith, Residency Program Director in Neuropathology
Department of Anatomical Pathology, room E4-03
Sunnybrook Health Sciences Centre
2075 Bayview Avenue, Toronto, Ontario, Canada
Phone (416)480-6100 x 88055
Fax (416)480-4271
e-mail: julia.keith@sunnybrook.ca

Resources  The university division of Neuropathology has staff and facilities at The
University Health Network (UHN), The Hospital for Sick Children, St. Michael's
Hospital, Sunnybrook Health Sciences Centre and Mt. Sinai Hospital. The
training program, however, operates as a single unit.

Curriculum  Neuropathology is a 5 year program structured as follows:

PGY1  The first year is a general clinical year similar to rotating internship with
rotations in Internal Medicine, Neurology, Surgery, Neurosurgery, Pediatrics,
Neuroradiology and Neuropathology.

PGY2  The next 12 months is composed of “core” training in anatomical
pathology. This provides experience in both autopsy and surgical pathology.

PGY3-5  24 months are spent in core neuropathology training using
neurosurgical and neuroautopsy cases. Teaching is provided in neuroanatomy,
immunohistochemistry, muscle histochemistry, electron microscopy and
concepts of molecular biology as it applies to neuropathology. Up to 12 months
can be spent on elective rotation and/or research.

Elective rotations often include:
Neurology, neuroradiology, neurosurgery

Research  May be based on clinical material or an experimental project may be
undertaken. Areas of research interest in the division include degenerative
diseases, cerebrovascular disease, and pediatric neuropathology at both the
morphological and molecular level. See "research rotations" on page 63-65 for
further details. Dr Cynthia Hawkins is the resident research advisor for
Neuropathology.

Academic Half Day  Attendance is mandatory for all Neuropathology residents. Wednesdays from
2-5, Hospital for Sick Kids Pathology conference room. An example of the
curriculum for the academic half day cycle is in the appendix.

In-training examinations on academic half day material will be undertaken
approximately 3 times per year. See appendix for an example.

Selection Criteria  see page 5
Interviews
All applicants will be interviewed but it is the responsibility of the applicant to call Dr. Keith’s office for an appointment. Out-of-town interviews will be scheduled during the national interview period. On site interviews are the only type permitted.

Personal Letter
A one page personal letter is required. The letter should include your reason for selecting Neuropathology and your attributes that suit you to a career in Neuropathology.

Reference Letters
The 3 reference letters must be from staff physicians

STAFF MEMBERS & THEIR RESEARCH/SERVICE INTERESTS

Neuropathologists:
Dr. Juan M Bilbao
Pathogenesis of neuromuscular diseases
Neuromuscular disorders
Neuro-oncology
Neurodegeneration

Dr. Julia Keith (residency program director)
Education
Neurodegeneration
Neuromuscular disorders

Dr. William Halliday
Neuro-oncology
Radiology-Pathology correlations
Pediatric neuropathology, including forensic

Dr. Patrick Shannon
Developmental neuropathology

Dr. Cynthia Hawkins (resident research advisor)
Pediatric neuropathology, including forensic
Molecular biology of pediatric brain tumours

Dr. Sidney Croul
Neuro-oncology
Neuro-virology as it relates to oncology.
Dr. Tim-Rasmus Kiehl  
Developmental neurobiology  
Neuro-oncology

Dr. Lili-Naz Hazrati  
Neurodegenerative diseases

Dr. David Munoz  
Neurodegenerative diseases

Dr. Jason Karamchandani  
Neuro-oncology

Paula Nixon  
Coordinator, Postgraduate Programs  
Department of Laboratory Medicine and Pathobiology, U of T  
Tel: 416/978-7535; Fax: 416/978-7361  
email: pathology.residency@utoronto.ca

NEUROPATHOLOGY TRAINING PROGRAM
Criteria for Selection of Trainees into the Neuropathology Program

a. Academic transcript  
b. Honours and awards  
c. Additional degrees eg. MSc, PhD  
d. Demonstrated interest in neuropathology - electives in pathology, neuropathology, neurology, neurosurgery  
e. Publications in: Pathobiology of Diseases, Neurology, Neurosurgery, Neuroanatomy  
f. Referee letters  
g. Interview  
h. Personal letter of the candidate

The above criteria are in descending order of importance
GENERAL GOALS OF THE NEUROPATHOLOGY RESIDENCY PROGRAM

Neuropathology is the medical specialty which deals with the structural basis, pathobiology and diagnosis of diseases of the central, peripheral and autonomic nervous systems and skeletal muscle.

The overall goals of the Neuropathology Training Program are to acquire the knowledge and skills to qualify and function as a specialist in Neuropathology as follows:

1. To acquire the technical skills pertinent to the practise of neuropathology.
2. To acquire a high level of proficiency in neuroanatomy, neurohistology, myology and ultrastructure of the nervous system and muscle.
3. To acquire a working knowledge of those areas of neurophysiology, neurochemistry and molecular biology that is important in the interpretation of disease and selection of therapeutic procedures.
4. To formulate a neuropathologic diagnosis after gross and microscopic examination of biopsy and autopsy specimens.
5. To integrate clinical, radiologic, neurophysiologic, and laboratory data in the formulation of the pathophysiology of the disease process.
6. To communicate effectively the material in #4 and #5 above with clinical colleagues.
7. To effectively teach neuropathology to medical students, trainees in pathology and other disciplines, clinical colleagues, colleagues in other Laboratory Medicine specialties, and the lay public.
8. To effectively expand the knowledge base in neuropathology, the neurosciences, and pathology by studies of clinical material and/or basic research.
9. To gain competence in diagnostic Anatomical Pathology.
10. To know the principles of Bioethics as related to Laboratory Medicine.
11. To have knowledge of Laboratory Management.
These goals will be obtained by the following means.

The trainee will:

1) Observe and participate in CNS autopsies.

2) Present autopsy findings at organ recital or clinicopathologic conferences.

3) Observe and participate in gross and microscopy of neurosurgical specimens and neuromuscular specimens, and the generation of appropriate neuropathology reports.

4) Participate in quick sections diagnosis.

5) Gain an understanding of the daily operation of the neuropathology laboratory.

6) Become acquainted with laboratory safety precautions.

7) Become familiar with the use of computers in laboratory medicine, and with digital pathology.

8) Appreciate the importance of team work within the department.

9) Follow the curriculum of the neuropathology academic half day, and successfully complete the in-training examinations within. This curriculum requires the resident to attend and participate in the weekly Neuropathology academic half day, Wednesdays from 2-5 in room 3108, Hospital for Sick Children.

To accomplish these goals, the following objectives have to be met. These objectives closely follow the specialist roles as put forth by the CanMEDS 2000 project*, but modified for the practice of neuropathology.

GENERAL OBJECTIVES OF THE NEUROPATHOLOGY RESIDENCY

In order to achieve competency in neuropathology, the trainee must become an effective medical expert, communicator, collaborator, manager, health advocate, scholar-researcher and professional in functioning as a neuropathologist. Each of these roles has specific objectives as follows.

1. MEDICAL EXPERT

On completion of training the neuropathology trainee must be able to:

1.1  Demonstrate diagnostic and technical skills in neuropathology for ethical and effective patient care

To achieve this, the neuropathology trainee must be competent to:

1.1.1. Obtain relevant clinical, radiologic, neurophysiologic data and use this information for the neuropathologic examination. For this the trainee must be able to:
   1.1.1.1. Extract relevant information from the clinical chart as supplied by the health care team.
   1.1.1.2. Summarize this information orally and in writing.
   1.1.1.3. Use this information to appropriately plan the neuropathology autopsy.
   1.1.1.4. Use this information to appropriately process a biopsy.

1.1.2. Demonstrate an ability to adequately harvest the following neuropathologic specimens at autopsy, if appropriate for the study of the case and provided that a valid consent is available. For this the trainee must be able to remove:
   1.1.2.1 the adult brain
   1.1.2.2 the brain of a fetus, neonate, infant or child in the most effective manner to demonstrate malformations.
   1.1.2.3 the spinal cord (anterior and posterior approach)
   1.1.2.4 peripheral nerves/nerve plexus/ganglia
   1.1.2.5 skeletal muscles
   1.1.2.6 the autonomic nervous system
   1.1.2.7 the cervical and intracranial carotid artery in toto intact
   1.1.2.8 the cervical portion of the vertebral artery
1.1.2.9 the cervical spine and craniocervical junction en block
1.1.2.10 the pituitary gland
1.1.2.11 the sphenoid sinus and cavernous sinus
1.1.2.12 the intracranial dura and/or portions of the skull
1.1.2.13 the orbital contents

1.1.3 Apply appropriate precautions for cases with conventional infectious etiologies.

1.1.4. Apply appropriate precautions for cases suspected to have a prion etiology.

1.1.5. Demonstrate an ability to cut the brain, spinal cord and other samples taken at autopsy. For this, the trainee must be able to:

   1.1.5.1. Cut and prepare blocks of the specimens listed under 1.1.2. in a manner that is appropriate to the clinical, radiologic, neurophysiologic, and laboratory data obtained.
   1.1.5.2. Document the gross findings of specimens.
   1.1.5.3. Photograph gross specimens.

1.1.6. Demonstrate an ability to adequately handle surgical neuropathology specimens. For this trainee must be able to:

   1.1.6.1. Describe the gross findings orally and in writing.
   1.1.6.2. Appropriately cut and sample surgical specimens depending on the clinical, radiologic, neurophysiologic, and laboratory data obtained.
   1.1.6.3. Be proficient in making smears.
   1.1.6.4. Be proficient in making touch preparations.
   1.1.6.5. Be proficient in the embedding of fresh tissue, the cutting and staining of frozen sections.
   1.1.6.6. Appropriately sample surgical specimens for rush diagnosis.
   1.1.6.7. Effectively communicate the rush diagnosis to the operating neurosurgeon.
   1.1.6.8. Apply appropriate precautions for dealing with a surgical specimen with conventional infectious etiologies.
   1.1.6.9. Apply appropriate precautions for dealing with surgical specimens suspected to harbour prions.
1.1.7. Demonstrate knowledge and understanding of the methods of tissue fixation and processing in neuropathology. For this, the trainee should:

1.1.7.1. Know the principles of fixation, the types of fixatives used and their indications in the practice of neuropathology, for both light and electron microscopy.

1.1.7.2. Know the principles of tissue fixation and processing for paraffin embedding.

1.1.7.3. Know how to cut paraffin sections.

1.1.7.4. Know the principles of fixation and processing of tissues for plastic embedding.

1.1.7.5. Know how to cut semithin (iji) plastic sections and stain them with Toluidine blue.

1.1.7.6. Know how to cut thin plastic sections and mount them on grids and stain them for electron microscopy.

1.1.7.7. Know the principles of fixation and processing of specimens for CSF cytology.

1.1.7.8. Know the principles of fixation and processing of specimens for CSF cell block.

1.1.8. Demonstrate knowledge of the principles of histologic staining and the use of these stains in the examination of diseases of the central nervous system (CNS), peripheral nervous system (PNS), autonomic nervous system (ANS) and muscle. For this the trainee must be able to:

1.1.8.1. Understand the basis of the routine stains and special stains used in the examination of the ONS, PNS, ANS and muscle.

1.1.8.2 Understand the basis of histochemistry

1.1.8.3. Understand the basis of immunohistochemistry

1.1.8.4. Understand the utility of the immunocytochemical stains used in neuropathology.

1.1.8.5 Understand the basis of in situ hybridization

1.1.8.6. Select the appropriate technique relevant to the problem based on the gross, histologic, clinical, radiologic, neurophysiologic, and laboratory data available.

1.1.8.7. Interpret the normal, abnormal and artifactual microscopic findings demonstrated by each of these stains in tissue sections and/or exfoliative CSF cytology.
1.1.8.8. Understand the basis of, and be able to do, peripheral nerve fibre teasing techniques.

1.1.8.9. Understand the basis of, and be able to do morphometry.

1.1.9. Demonstrate the ability to adequately describe and record microscopic findings. For this, the trainee should be able to:

1.1.9.1. Adequately describe microscopic findings verbally and in writing.

1.1.9.2. Take photomicrographs.

1.1.10. Demonstrate adequate skill in electron microscopy. For this, the trainee should be able to:

1.1.10.1. Understand the principles of electron microscopy.

1.1.10.2. Operate the electron microscope and take electron micrographs.

1.1.10.3. Have a basic understanding of the maintenance of the electron microscope.

1.1.10.4. Have a basic understanding of trouble-shooting in electron microscopy.

1.1.10.5. Print electron micrographs.

1.1.10.6. Describe ultrastructural findings.

1.1.10.7. Correlate the electron microscopic findings with the gross, light microscopic, clinical, radiologic, neurophysiologic and laboratory data.

1.1.11. Demonstrate an ability to prepare a neuropathology autopsy report with an interpretation appropriate to the clinical setting. For this the trainee should be able to:

1.1.11.1. Summarize relevant gross and microscopic findings.

1.1.11.2. Correlate these findings with the known clinical, radiologic, neurophysiological and laboratory data.

1.1.11.3. Provide neuropathologic diagnosis(es).

1.1.11.4. Interpret the findings in light of the findings in the general autopsy.

1.1.11.5. Discuss the pathophysiology of the disease process in the particular patient being discussed.

1.1.11.6. Discuss the relationship of the neuropathologic findings to the cause of death.
1.1.12. Demonstrate an ability to produce a neuropathology surgical report with an interpretation appropriate to the clinical setting. For this, the trainee should be able to:

1.1.12.1. Describe the gross and microscopic findings (see sections 1.1.6 and 1.1.10).

1.1.12.2. Correlate these findings with the known clinical, radiologic, neurophysiologic and laboratory data.

1.1.12.3. Provide neuropathologic diagnosis(es).

1.1.12.4. Discuss the pathophysiology of the disease process as it applies to that particular patient.

1.1.12.5. Recommend any further investigations that may be helpful, based on the biopsy findings.

1.1.13. Demonstrate an ability to use microcomputers. For this, the trainee should be able to:

1.1.13.1. Use a word processing, data base and statistics program.

1.1.13.2. Use graphics and presentation programs.

1.1.13.3. Be familiar with the applications of computers to laboratory medicine in general and neuropathology in particular.

1.1.14. Demonstrate an ability to run a quality control program in neuropathology. For this, the trainee should be able to:

1.1.14.1. Participate in a conference with colleagues in the discussion of routine, interesting, and difficult cases.

1.1.14.2. Be familiar with quality control programs for tissue processing and staining.


1.1.15. Be able to perform a general autopsy
1.2 Access and apply relevant information to the practice of neuropathology. To this end, the neuropathology trainee must be competent within the fields of:

A. ANATOMICAL PATHOLOGY (FOCUS OF THE PGY2 YEAR)

1.2.1. To perform and interpret autopsy and surgical pathology as it relates to the nervous system at a level expected of an Anatomic Pathologist and to integrate general autopsy findings with those in the CNS, PNS and muscle. To achieve this, trainee should have a general knowledge of:

1.2.2.1. the normal gross anatomy of the body.
1.2.2.2. the histology of the body organs.
1.2.2.3. the physiology of the individual body organs.

1.2.2. Demonstrate a general knowledge of the general pathologic reactions of the body organs (general pathology). For this trainee should have a general knowledge of:

1.2.2.1. the mechanisms of cellular injury and repair.
1.2.2.2. inflammation.
1.2.2.3. immunity and immune mediated diseases.
1.2.2.4. genetics and the molecular basis of cell function and dysfunction.
1.2.2.5. neoplasia.
1.2.2.6. systemic nutritional and metabolic disorders.
1.2.2.7. the influences of environmental and toxic factors on the body.
1.2.2.8. infectious diseases - bacterial, fungal, viral, rickettsial and parasitic - and their effect on the body.
1.2.2.9. the types of disorders which affect the fetus, infant, and child.

1.2.3. Demonstrate a general knowledge of the pathology and pathophysiology of disorders of the organ systems (systemic pathology). For this trainee should have a general knowledge of the disorders of:

1.2.3.1. the heart and blood vessels.
1.2.3.2. the hematopoietic system, lymph nodes and the mechanisms of thrombosis.
1.2.3.3. the respiratory system.
1.2.3.4. the head and neck.
1.2.3.5. the gastrointestinal tract, liver, biliary tract and pancreas.
1.2.3.6. the kidneys and genitourinary tract.
1.2.3.7. the breast, particularly neoplasia.
1.2.3.8. the endocrine system.
1.2.3.9. the integument.
1.2.3.10 the skeletal system and connective tissues.

1.2.3b Learn to recognize the histologic and immunohistochemical appearances of systemic malignancies that can affect the nervous system, either as metastasis or as direct involvement from adjacent structures.

B. BASIC NEUROSCIENCES

1.2.4. Have a general knowledge of the structure and function of the CNS, PNS, ANS and skeletal musculature.

For this, the trainee should have a general knowledge of:

1.2.4.1. the normal gross, light and electron microscopic anatomy of the brain, spinal cord and their coverings and vasculature.

1.2.4.2. the neurophysiology of the brain and spinal cord and how they relate to the gross and microscopic CNS anatomy.

1.2.4.3. the neurochemistry of the brain and spinal cord.

1.2.4.4. the molecular genetics and molecular biology of the brain and spinal cord.

1.2.4.5. the normal gross and microscopic anatomy of the PNS.

1.2.4.6. the neurophysiology of the PNS, and how this relates to the microscopic anatomy.

1.2.4.7. the neurochemistry of axonal transport and action potential propagation.

1.2.4.8. the molecular biology of axons and the neuromuscular junction.

1.2.4.9. normal skeletal muscle gross and microscopic anatomy.

1.2.4.10. the biochemistry of skeletal muscle and its relationship to muscle contraction, and how this relates to the ultrastructure of muscle.

1.2.4.11. the molecular biology of skeletal muscle.
1.2.4.12. the ultrastructural features, physiology, biochemistry and molecular biology of the neuro-muscular junction and how specific perturbations of these lead to specific clinical, physiologic and laboratory abnormalities.

1.2.4.13. the embryologic development of the CNS, PNS and skeletal muscle and its relationship to malformations, the molecular biology and genetics associated with malformations.

1.2.4.14 how specific derangements, focal or general, in structures and/or function of the CNS, PNS, ANS and muscle leads to specific clinical radiologic, clinical neurophysiologic and laboratory abnormalities.

C. CLINICAL NEUROPATHOLOGY

1.2.5. Have a detailed knowledge of the basic cellular reactions of the CNS, PNS, ANS and skeletal muscle. For this, the trainee should be able to understand and have knowledge of:

1.2.5.1. the basic reactions of the neuron and its processes.

1.2.5.2. the basic reactions of glial cells.

1.2.5.3. the basic reactions of the meninges of the CNS.

1.2.5.4. the normal and developmental and basic reactions of the CNS during the prenatal, perinatal and childhood periods.

1.2.5.5. the gross, microscopic and physiologic changes associated with increased intracranial pressure, cerebral edema and hydrocephalus.

1.2.5.6 light and electron microscopic changes in the PNS and muscle

1.2.5.7. the changes in the PNS and muscle secondary to systemic diseases

1.2.5.8. the differences in changes induced by denervation vs primary muscle disease in muscle.

1.2.6. Have a detailed knowledge of the specific disease processes of the CNS, PNS, ANS and muscle. For this the trainee should have knowledge of the molecular genetics, molecular biology, etiology, pathophysiology, gross and microscopic pathology and clinicopathologic correlations for the following disease categories:

Central Nervous System Diseases

1.2.6.1. Trauma.
1.2.6.2. The effects of systemic hypoxia and hypotension
1.2.6.3. Diseases involving blood vessels supplying and draining the CNS.
1.2.6.4. The effects of metabolic and nutritional disorders on the CNS.
1.2.6.5. The effects of toxins and drugs on the CNS.
1.2.6.6. The effects of physical agents, including radiation, on the CNS.
1.2.6.7. Schizophrenia, manic-depressive psychosis and other psychoses.
1.2.6.8. Seizure disorders.
1.2.6.9. Disease processes affecting the pituitary gland, hypothalamus and hypothalamic-pituitary axis.
1.2.6.10. Disease processes involving the skull and spinal column, and their secondary effects on the CNS.
1.2.6.11. The effects of systemic diseases on the CNS, including paraneoplastic syndromes.
1.2.6.12. Bacterial, fungal, parasitic, viral, and rickettsial infections of the CNS.
1.2.6.13. Prion diseases of the CNS.
1.2.6.14. Disease processes which can lead to dementia.
1.2.6.15. Movement disorders and system degenerations of the CNS.
1.2.6.16. Primary and Metastatic neoplasms of the CNS.
1.2.6.17. Demyelinating diseases of the CNS.
1.2.6.18. Acquired lesions in the perinatal, postnatal and childhood periods. (Diseases of grey matter, diseases of white matter, diseases of both grey and white matter, arterial diseases, venous diseases, trauma in utero and postnatally, infection and hemorrhage).
1.2.6.19. Lesions with a genetic basis and those which are associated with syndromes.
1.2.6.20. Congenital malformations of the CNS and their associations.
1.2.6.21. Metabolic diseases which manifest in the fetus, neonate and child. (Lysosomal storage diseases and peroxisomal diseases).

1.2.6.22. Degenerative diseases which affect the CNS, PNS, and musculoskeletal system in infants and childhood.

1.2.6.23. Sudden unexpected death in infants.

1.2.6.24. Childhood CNS tumors.

**Peripheral Nervous System Diseases**

1.2.7.1. Peripheral neuropathies and their classification.

1.2.7.2. Mechanical injury to peripheral nerves.

1.2.7.3. Temperature injury to peripheral nerves.

1.2.7.4. Radiation injury to peripheral nerves.

1.2.7.5. The effects of nutritional deficiency on peripheral nerves.

1.2.7.6. The effects of environmental agents and toxins on peripheral nerves.

1.2.7.7. The effects of drugs on peripheral nerves.

1.2.7.8. The effects of systemic metabolic diseases on peripheral nerves.

1.2.7.9. The inherited peripheral neuropathies.

1.2.7.10. The inflammatory neuropathies.

1.2.7.11. Neuropathies due to infectious agents.

1.2.7.12. Paraneoplastic neuropathies.

1.2.7.13. The effects of vascular disease (including the vasculitides) on peripheral nerves.

1.2.7.14. Neoplasms of peripheral nerve.

**Autonomic Nervous System Disorders**

1.2.8.1 Orthostatic Hypotension

1.2.8.2 Botulism

1.2.8.3 Autonomic neuropathy in infants and children

1.2.8.4 Congenital megacolon

1.2.8.5 The neuroanatomic basis for pupillary, bowel and bladder dysfunction
Muscle Diseases

1.2.9.1. Myopathies and their classification.
1.2.9.2. Disorders of neuromuscular transmission.
1.2.9.3. The effects of motor neuron disorders on skeletal muscles.
1.2.9.4. Dystrophinopathies.
1.2.9.5. Sarcoglycanopathies and other limb girdle muscular dystrophies.
1.2.9.6. Non-infectious inflammatory myopathies.
1.2.9.7. Myopathies due to infectious agents, including parasites.
1.2.9.8. Ion-channel myopathies.
1.2.9.9. Mitochondrial cytopathies.
1.2.9.10. Lipid storage myopathies.
1.2.9.11. The glycogenoses.
1.2.9.12. The congenital myopathies.
1.2.9.13. The effects of systemic metabolic/endocrine disorders on muscle.
1.2.9.15. Primary neoplasms of muscle.

1.3 Demonstrate effective consultation, as a neuropathologist, with the rest of the patient care team, education and legal opinions

To achieve this, the trainee must be competent to:

1.3.1 Recognize personal limits of expertise.

1.3.1.1. Recognize when to seek consultation from another neuropathologist.

1.3.1.2. Recognize when to seek consultation from a specialist other than a neuropathologist

1.3.2. Express findings and interpretations for medico-legal purposes. For this, the trainee must be able to:

1.3.2.1. Formulate findings and interpretations such that they are relevant to the medico-legal implications of the case.
1.3.2.2. Express findings and interpretations such that they are understood by persons without medical training, such as lawyers, or legal professionals, and the lay public.

2. **COMMUNICATOR**

On completion of training the neuropathology trainee must be able to:

2.1 **Establish a relationship of trust and respect with clinical and non-clinical colleagues, patients and their families, and the community**

To achieve this, the trainee must be able to:

2.1.1. Establish a good working relationship with clinical and non-clinical colleagues.

2.1.2. Interact with patients or their family, who, from time to time, may inquire about results of biopsies or more information about the diseases they have been diagnosed with.

2.1.3. Interact with patients or their family to obtain more clinical information, when appropriate.

2.1.4. Supply information as required to the community at large, concerning disease processes which affect the nervous system and muscle.

2.2 **Obtain and synthesize relevant information from clinical and other colleagues and listen carefully.**

For this, the trainee must be able to:

2.2.1. Determine the appropriate information needed in the work-up of the case.

2.2.2. Listen carefully for any details which may contribute to the understanding of the case.

2.3 **Discuss information freely with clinicians and, if necessary, patients and their families.**

For this, the trainee must be able to:

2.3.1. Communicate both verbally and in writing, the results of neuropathology investigations in a time period specified by a given department to clinical colleagues, so that patient care is not delayed or jeopardized.
2.3.2 Understand the basic necessary content and structure of a neuropathology report for autopsy and surgical cases, and compose accurate and succinct pathology reports.

2.3.3 Be able to articulately express a degree of diagnostic uncertainty within a pathology report.

2.3.4 Be willing to discuss results with the family, as they become available and provide a time-line for the final diagnosis.

2.3.5 Be able to present neuropathology findings to non-neuropathologists in intra-departmental and inter-departmental (multi-disciplinary) rounds.

3. **COLLABORATOR**

On completion of training the neuropathology trainee must be able to:

3.1 **Collaborate effectively with other physicians and health care professionals.**

To achieve this, the neuropathology trainee must be competent to:

3.1.1 Consult with clinicians on obtaining clinical data, clinicopathologic correlations, and suggest additional avenues of clinical and/or laboratory investigations.

3.1.2 Realize the limitations of laboratory technology and expertise which can be brought to bear on a given case.

3.1.3 Consult with other health professionals, especially nurses and social workers who may have valuable information concerning the clinical course and environmental factors, important in the disease process.

3.2 **Contribute effectively to other interdisciplinary team activities.**

To achieve this, the neuropathology trainee must:

3.2.1 Recognize the expertise of other health team individuals.

3.2.2 Respect the roles and opinions of other health team members.

3.2.3 Contribute to health team development and conflict resolution.

3.2.4 Contribute neuropathology expertise to the health team/s tasks.

3.3 **Cultivate a prosperous working relationship with other residents in Neuropathology training, and create vibrant group learning activities (such as the academic half day).**
4. MANAGER

On completion of training, the neuropathology trainee must be able to:

4.1 **Utilize time and resources effectively to balance patient care, learning needs and outside activities.**

   To achieve this, the neuropathology trainee must:

   4.1.1. **Be an effective time manager.**

   4.1.2. **Realize the physical and financial limitations of resources available to in the practice of neuropathology at the particular locale.**

   4.1.3. **Plan self-learning and self-assessment learning goals and objectives.**

   4.1.4. **Provide time for, and become involved in outside activities.**

4.2 **Allocate finite health care resources wisely.**

   To achieve this, the neuropathology trainee must:

   4.2.1. **Use discretion in ordering special stains and special techniques, to optimize utilization of resources without unnecessary waste.**

4.3 **Work effectively and efficiently in a health care organization.**

   For this the neuropathology trainee must:

   4.3.1. **Understand the roles and responsibilities of a laboratory physician in general and a neuropathologist in particular.**

   4.3.2. **Have a general understanding of the organization and function of the Canadian health care system.**

   4.3.3. **Have a general knowledge of the forces of change which impact on the Canadian health care system and health care policy.**

   4.3.4. **Work effectively with other health team professionals, and understand the roles of other individuals in the laboratory including MLTs, PA's and laboratory managers.**

   4.3.5. **Be able to prioritize neuropathology specimens based on clinical urgency.**

   4.3.6. **Understand the principles of a quality assurance program in the laboratory.**

   4.3.7 **Acquire skills in the development of guidelines relevant to the practice of neuropathology.**

4.4 **Effectively utilize information technology to optimize patient care, continual self-learning, and other activities.**
To achieve this, the neuropathology trainee must be competent to:

4.4.1. Use patient-related clinical and laboratory based data bases.
4.4.2. Access micro computer-based information.
4.4.3. Have a general understanding of medical informatics.

4.5 Learn to use digital pathology as a tool for:

4.5.1 Intra-operative Neuropathology consultation
4.5.2 Education

5. **HEALTH ADVOCATE**

On completion of training, the neuropathology trainee must be competent to:

5.1 **Identify the important determinants of health affecting patients, with respect to diseases of the CNS, PNS, ANS and skeletal muscle.**

To this end, the neuropathology trainee must be able to recognize:

5.1.1. the biological factors that influence the diseases of the CNS, PNS and skeletal muscles.
5.1.2. the economic factors that influence the diseases of the CNS, PNS and skeletal muscles.
5.1.3. the environmental factors that influence the diseases of the CNS, PNS and skeletal muscle.
5.1.4. the psychological and social factors that influence the diseases of the CNS, PNS and skeletal muscles.
5.1.5. Incorporate the factors listed in 5.1.1.- 5.1.4. in the pathogenesis of diseases of the CNS, PNS, ANS and skeletal muscle.

5.2. **Recognize and respond to those issues, settings, circumstances, or situations in which advocacy on behalf of patients with disorders of the CNS, PNS or skeletal muscle, or on behalf of professions or society as appropriate.**

For this the neuropathology trainee must be competent to:

5.2.1. **Identify populations at risk for specific disease entities involving the CNS, PNS or skeletal muscle.**
5.2.2. Identify current governmental or other policies that affect the health of individuals with disorders of the CNS, PNS or skeletal muscle.

5.2.3. Recognize the fundamental role of epidemiological research in understanding the pathophysiology and etiology of disorders of the CNS, PNS and skeletal muscle.

5.2.4. Describe how public policy is developed with respect to diseases of the CNS, PNS and skeletal muscle.

5.2.5. Employ methods to influence the development of social and health policies, which affect individuals with diseases of the CNS, PNS and skeletal muscle.

5.2.6. Work with professionals and lay societies concerned with diseases of the CNS, PNS and skeletal muscle in education, research, treatment, and prevention of these diseases.

5.3 Be familiar with the means of minimizing laboratory error, including laboratory accreditation and quality assurance programs.

5.3.1 Contribute and attend available Neuropathology consensus rounds.

6. **SCHOLAR**

On completion of training, the neuropathology trainee must be able to:

6.1 Develop, implement and document a personal continuing education strategy

To achieve this, the neuropathology trainee must:


6.1.2. Access personal learning needs.

6.1.3. Choose an appropriate learning method and subject matter(s).

6.1.4. Evaluate the outcome of the self-learning experience.

6.1.5. Apply the new knowledge to his/her practice of neuropathology.

6.2 Apply the principles of critical appraisal to sources of medical information.

To achieve this, the neuropathology trainee must:

6.2.1. Incorporate an attitude of scientific inquiry and the use of evidence into the process of making neuropathologic diagnoses.
6.2.2. Select the appropriate questions to be answered.

6.2.3. Research the literature for answers to the question.

6.2.4. Keep current with the evidence-based literature pertinent to the practice of neuropathology

6.3 Facilitate the learning of patients, students, residents and other health professionals.

To achieve this, the neuropathology trainee must:

6.3.1. Assist these groups in defining learning needs and goals.

6.3.2. Provide direction to these groups for educational development.

6.3.3. Provide constructive feed-back to these individuals in the learning process.

6.3.4. Teach neuropathologic principles to these groups, at rounds, conferences and other forums.

6.3.5. Apply the principles of adult learning in interactions with students, residents, colleagues and others.

6.4 Contribute to the development of new knowledge.

To achieve this, the neuropathology trainee must:

6.4.1. Develop research skills for individual and collaborative research endeavors in clinical, applied or basic science research in the diseases of the CNS, PNS, ANS or skeletal muscle.

To achieve this, the trainee should be able to:

6.4.1.1. Formulate a research question.

6.4.1.2. Conduct a literature research relevant to the question.

6.4.1.3. Identify, consult and collaborate with experts in the area of the research question.

6.4.1.4. Propose a methodologic approach to answer the question.

6.4.1.5. Carry out the research proposal.

6.4.1.6. Defend and disseminate the results of the research.

6.4.1.7. Identify areas for further research which arise from the results.

7. PROFESSIONAL

On completion of training the neuropathology trainee must be able to:
7.1 Deliver the highest quality practice of neuropathology with integrity, honesty and compassion.

To achieve this, the neuropathology trainee must:

7.1.1. Use appropriate strategies to maintain and advance professional competence in neuropathology. For this, see 6.1 and 6.2.

7.1.2. Continually evaluate his/her abilities, knowledge and skills. For this, see 6.1.

7.1.3. Be aware of personal professional limitations. For this, see 1.3.1.

7.1.4. Demonstrate integrity when dealing with colleagues and others.

7.1.5. Demonstrate honesty in dealing with colleagues and others.

7.1.6. Demonstrate compassion for individuals, and their families, affected with disorders with which trainee encounters in the practice of neuropathology.

7.2 Exhibit appropriate personal and interpersonal behaviors.

To achieve this, the neuropathology trainee must:

7.2.1. Be accountable for his/her personal actions.

7.2.2. Have a high degree of self awareness.

7.2.3. Maintain an appropriate balance between personal and professional roles.

7.2.4. Address interpersonal differences in professional relations.

7.3 Practice neuropathology in an ethically responsible manner that respects the medical, legal and professional obligations of belonging to a self regulating body.

To achieve this, the neuropathology trainee must:

7.3.1. Know and understand the professional, legal and ethical codes to which physicians are bound.

7.3.2. Recognize, analyze and attempt to resolve ethical issues in the practice of neuropathology.

7.3.3. Understand and apply relevant legislation relating to the health care system in order to guide him/her in the practice of neuropathology.

7.3.4. Recognize, analyze and know how to deal with unprofessional behaviors in the practice of medicine, including but not exclusive to neuropathology, taking into account local and provincial regulations.
ROTATION SPECIFIC OBJECTIVES FOR THE NEUROPATHOLOGY RESIDENCY

These objectives are intended to highlight those areas which *are to be emphasized* in the specific rotations.

PGY1 year

INTERNAL MEDICINE

MEDICAL EXPERT

a) Develop an approach to the investigation and management of:
   i) stroke
   ii) vasculitis
   iii) intracranial hemorrhage
   iv) bleeding diatheses
   v) intracranial infections
   vi) neuromuscular disease

b) Develop an approach to:
   i) the abnormal chest x-ray
   ii) pulmonary function tests
   iii) the diagnosis and management of lung diseases to include:
       - solitary lung nodule
       - pulmonary infiltrates
       - obstructive and restrictive lung disease

c) Develop an approach to the diagnosis and management of:
   - gastrointestinal bleed
   - inflammatory bowel disease
   - malabsorption
   - cirrhosis
   - hepatitis
   - gastrointestinal neoplasms
   - role of the endoscopic biopsy

HEALTH ADVOCATE

a) Identify the important determinants of health affecting patients, with respect to diseases of the nervous system and skeletal muscle.

   i) learn the modifiable risk factors for medical conditions that increase a patient's risk for cerebrovascular disease (ie. hypertension, diabetes,
hypercholesterolemia), and learn the basic principles for managing these conditions.

**COLLABORATOR**

a) Learn to be an active and effective member of the inpatient internal medicine team. This will include collaborating effectively with other physicians and health care professionals, learning and respecting the roles of other team members, and communicating clearly and effectively with other team members.

**COMMUNICATOR**

a) Strengthen one's skills in obtaining and documenting patient's history and physical examination.

**NEUROLOGY**

**MEDICAL EXPERT**

a) Become competent in conducting a neurological examination.

b) Be exposed to lumbar puncture, EEG, EMG, nerve conduction studies and their interpretation.

c) Learn functional neuroanatomy, and be able to localize lesions within the CNS based on symptoms and signs.

d) Learn the basic principles of investigation and management of the following diseases:
   - stroke and TIA (including prevention, prevention of recurrence and acute management)
   - primary and metastatic tumors of the nervous system
   - immune mediated myositis
   - temporal arteritis
   - multiple sclerosis
   - myasthenia gravis
   - dementia
   - parkinsonism
   - motor neuron disease
   - epilepsy
COLLABORATOR

a) Appreciate the value in inter-disciplinary communication in the diagnosis and management of neuro-oncology and neuro-muscular patients.

b) Be an active and engaged member of the in-patient neurology team.

COMMUNICATOR

a) Strengthen one's skills in obtaining and documenting patient's history and physical examination.

MANAGER

a) Learn the indications and yield of the following diagnostic procedures:
   - lumbar puncture
   - skeletal muscle biopsy
   - peripheral nerve biopsy
   - temporal artery biopsy
   - various forms of neuroradiologic studies (CT head, MRI head, SPECT, fMRI, angiography)

b) Appreciate the important issues surrounding resource allocation and management with respect to in-patient hospital care (ie. hospital beds, nursing staff, etc).

c) Learn to prioritize tasks in the triage and management of patients with varying neurological issues.

d) Recognize and appropriately respond to neurological emergency situations.

HEALTH ADVOCATE

a) Appreciate the public health issues associated with an aging population and increasing prevalence of neurodegenerative disorders.

b) Using CCVSI as an example, appreciate the role that the media and internet have in the dissemination of medical knowledge and opinion with the public, and become familiar with reputable public resources for medical information.

c) Identify the important determinants of health affecting pediatric patients, with respect to diseases of the nervous system and musculoskeletal system. These include biological, economic, environmental, psychological and social factors that influence disease. Incorporate these factors in the pathogenesis of diseases of the nervous system and skeletal muscle.
Recognize and respond to those issues, settings, circumstances, or situations in which advocacy on behalf of patients with disorders of the nervous system or skeletomuscular system is appropriate.

SCHOLAR

a) Become familiar with the most reputable scientific journals in the field of Neurology.
b) Participate in any available neurology journal club session and practice critical analysis of neurological research papers.
c) Develop an appreciation for the role of Neuropathology and Neuropathologists in neurology research.
d) Develop an appreciation for the role of Neurologists in Neuropathology research.

SURGERY

MEDICAL EXPERT

a) Attend the operating room to become familiar with general surgical technique and common surgical procedures.
b) Gain knowledge and experience in the management and complications of post operative patients.
c) Learn functional anatomy.

COLLABORATOR

a) Become familiar with the role of pathologists in the management of surgical patients including:
   - the indications and value of intra-operative pathology consultation
   - the role of pathologists in multi-disciplinary tumour board meetings

COMMUNICATOR

a) Strengthen one's skills in obtaining and documenting patient's history and physical examination.
b) Study the pathology reports of one's patients, and learn the expectations of the surgeons in terms of content and timeliness of pathology reports.
**NEUROSURGERY**

**MEDICAL EXPERT**

a) Gain experience in the investigation and management of intracranial, intraspinal and intrasellar masses and intracranial hemorrhages.
b) Attend the operating room and become familiar with common neurosurgical procedures such as stereotactic biopsies, craniotomy, tumor resections.
c) Become competent in conducting a neurological examination.
d) Learn functional neuroanatomy, and be able to localize lesions within the CNS based on symptoms and signs.

**MANAGER**

a) Appreciate the important issues surrounding resource allocation and management with respect to in-patient hospital care. (ie. hospital beds, nursing staff, etc).
b) Learn to prioritize tasks in the triage and management of patients with neurosurgical issues.
c) Learn the indications, risks and yield of the following procedures:
   - stereotactic brain biopsies
   - skeletal muscle biopsy
   - gross total resection of primary and metastatic brain tumours
   - discectomy
d) Recognize and appropriately respond to neurosurgical emergency situations.

**COLLABORATOR**

a) Become familiar with the role of neuropathologists in the management of neurosurgical patients including:
   - the indications and value of intra-operative neuropathology consultation
   - the role of neuropathologists in multi-disciplinary brain tumour board meetings
b) Learn the role of the neurosurgeon in the management of patients with the following:
   - craniocerebral trauma
   - primary and metastatic brain tumours
   - movement disorders
   - epilepsy
COMMUNICATOR

a) Strengthen one's skills in obtaining and documenting patient's history and physical examination.

b) Study the pathology reports of one's patients, and learn the expectations of the neurosurgeons in terms of content and timeliness of pathology reports.

HEALTH ADVOCATE

a) Learn the modifiable risk factors for cerebrovascular disease.

b) Be aware of activities and behaviors that predispose patients to craniocerebral trauma, and engage in counselling patients in the avoidance of these activities and behaviors.

SCHOLAR

a) Become familiar with the most reputable scientific journals in the field of Neurosurgery.

b) Participate in any available neurosurgery journal club session and practice critical analysis of neurosurgical research papers.

c) Develop and appreciation for the role of Neuropathology and Neuropathologists in neurosurgical research.

d) Develop an appreciation for the role of Neurosurgeons in neuropathology research.

PEDIATRIC NEUROLOGY

MEDICAL EXPERT

a) Gain knowledge and experience in the diagnosis and management of patients with:
   i) common congenital anomalies
   ii) genetic disorders
   iii) childhood malignancies, especially brain tumors
iv) epilepsy
b) Become competent in conducting an examination of the nervous system in a pediatric patient.
c) Learn functional neuroanatomy, and be able to localize lesions in the nervous system based on clinical signs and symptoms.
d) Learn functional neuro-embryology including the malformative disorders that arise from aberrant or erroneous neurodevelopment.

COLLABORATOR
a) Appreciate the role of the neurologist and neuropathologist in multi-disciplinary management teams for pediatric brain tumour patients.

HEALTH ADVOCATE
a) Know the modifiable risk factors for Sudden Infant Death Syndrome.
b) Identify the important determinants of health affecting pediatric patients, with respect to diseases of the nervous system and musculoskeletal system. These include biological, economic, environmental, psychological and social factors that influence disease. Incorporate these factors in the pathogenesis of diseases of the nervous system and skeletal muscle.
c) Recognize and respond to those issues, settings, circumstances, or situations in which advocacy on behalf of pediatric patients with disorders of the nervous system or skeletomuscular system is appropriate.

COMMUNICATOR
a) Strengthen one's skills in obtaining and documenting patient's history and physical examination, and gain experience in obtaining a medical history from parents of a patient.
b) Study the pathology reports of one's patients, and learn the expectations of the pediatric neurologists in terms of content and timeliness of pathology reports.
**NEURORADIOLOGY**

**MEDICAL EXPERT**

a) Be exposed to common neuroradiological procedures and the interpretation of findings.
b) Learn functional neuroanatomy using neuroimaging modalities.
c) Develop a differential diagnosis for lesions in the following neuroanatomical locations:
   - intra-axial brain lesions, extra-axial brain lesions
   - intra-ventricular, cerebellopontine angle, sella, pineal region, cauda equina
   - all compartments of the vertebral column and spinal cord
d) Learn the usual imaging characteristics for the following lesions of the nervous system:
   - low grade glioma, high grade glioma, meningioma, metastases, brain abscess, demyelinating plaque
e) Learn the basic principles behind the following neuroimaging techniques:
   - CT, MRI, fMRI, SPECT, PET

**COLLABORATOR**

a) Learn the role of the neuroradiologist in multi-disciplinary CNS tumour board meetings.
b) Learn the role of interventional neuroradiologists in the management of cerebrovascular disease.
b) Appreciate the value of clinical-radiographic-pathologic correlation in the diagnosis of difficult cases.

**COMMUNICATOR**

a) Learn the basic structure and content of a radiology report for each major modality of neuro-imaging.

**MANAGER**

a) Learn to prioritize imaging requests for patients with varying medical issues.
b) Appreciate the major issues regarding resource allocation in radiology, and the importance of prudent use of diagnostic imaging services.
PGY2 Year

ANATOMICAL PATHOLOGY

MEDICAL EXPERT

a) To perform and interpret autopsy and surgical pathology as it relates to the nervous system at a level expected of an Anatomic Pathologist and to integrate general autopsy findings with those in the CNS, PNS and muscle. To achieve this, trainee should have a general knowledge of:

   i) the normal gross anatomy of the body.
   ii) the histology of the body organs.
   iii) the physiology of the individual body organs.

b) Demonstrate a general knowledge of the general pathologic reactions of the body organs (general pathology). For this trainee should have a general knowledge of:

   i) the mechanisms of cellular injury and repair.
   ii) inflammation.
   iii) immunity and immune mediated diseases.
   iv) genetics and the molecular basis of cell function and dysfunction.
   v) neoplasia.
   vi) systemic nutritional and metabolic disorders.
   vii) the influences of environmental and toxic factors on the body.
   viii) infectious diseases - bacterial, fungal, viral, rickettsial and parasitic and their effect on the body.
   ix) the types of disorders which affect the fetus, infant, and child.

c) Demonstrate a general knowledge of the pathology and pathophysiology of disorders of the organ systems (systemic pathology). For this trainee should have a general knowledge of the disorders of:

   i) the heart and blood vessels (including atherosclerosis).
   ii) the hematopoietic system, lymph nodes and the mechanisms of thrombosis, coagulation and thrombolysis.
   iii) the respiratory system.
   iv) the head and neck.
   v) the gastrointestinal tract, liver, biliary tract and pancreas.
   vi) the kidneys and genitourinary tract.
vii) the breast, particularly neoplasia.
viii) the endocrine system.
ix) the integument.
x) the skeletal system and connective tissues.

d) Learn to recognize the histologic and immunohistochemical appearances of *systemic malignancies that can affect the nervous system*, either as metastases or as direct involvement from adjacent structures.
e) Develop a systemic approach to an 'unknown slide'.

COMMUNICATOR

a) Learn the basic structure and content of a pathology report.
b) Gain appreciation of the value of synoptic reporting, and learn the necessary content of a synoptic report.
c) Practice presenting neuropathology to anatomical pathologists.

COLLABORATOR

a) Learn the role of the neuropathologist in an Anatomic Pathology department.
b) Appreciate the role of the pathologist in multi-disciplinary management teams for tumour patients.
c) Become familiar with the role of pathologists in the management of surgical patients including the indications and value of intra-operative pathology consultation.
d) Gain appreciation for the role of MLT's, PA's and laboratory managers in a large academic pathology laboratory.

MANAGER

a) Become familiar with the basic principles of a quality assurance program in the laboratory.
b) Gain appreciation for the OALA accreditation process for Ontario laboratories.
c) Learn to prioritize various types of specimens within the laboratory based on clinical urgency, including but not limited to:
   i) appropriate indications and implications of a "stat" designation
   ii) rapid processing of selected specimens
d) Appreciate the importance of "Standard Operating Procedures" in the laboratory.

e) Learn the standards for "turn-around time" for surgical and autopsy cases.

f) Learn the standards for tissue retention of surgical and autopsy material.

g) Become familiar with the role and services provided by the Coroner's Office of Ontario, and the role of the forensic pathologist.

HEALTH ADVOCATE

a) Know the public health importance of the provision of adequate diagnostic services to Canadians.

b) Be familiar with laboratory safety guidelines, and with the basic content of a laboratory safety manual.

c) Identify the important determinants of health, including biological, economic, environmental, psychological and social factors that influence disease. Incorporate these factors in the pathogenesis of cardiovascular disease, infectious disease, and cancer.
PGY3-PGY5 Years

NEUROPATHOLOGY

The Hospitals participating in the Neuropathology Training Program and the Staff Neuropathologists at each Hospital are:

**Adult Neuropathology Training**

University Health Network: Dr T-R Kiehl, Dr S Croul, Dr L-N Hazrati
St. Michael’s Hospital: Dr D Munoz, Dr J Karamchandani
Sunnybrook Health Sciences Centre: Dr JM Bilbao, Dr J Keith

**Pediatric Neuropathology Training**

The Hospital for Sick Children: Dr WC Halliday, Dr C Hawkins
Mt. Sinai Hospital: Dr P Shannon

At each of these Hospitals the Neuropathology resident can obtain training in:

I  **Technical Skills:**

1. Training in the performance of dissections pertinent to the study of central and peripheral nervous systems and muscle.

2. Learn appropriate sampling of tissues in specific neurological diseases.

3. To learn the principles and follow the procedures used in processing tissues for light microscopy, special stains, EM, Fluorescence Microscopy, Histochemistry, Immunohistochemistry and Morphometry.

II  **Diagnostic Neuropathology:**

Gain experience in the diagnosis and differential diagnosis of:

1. Diseases of the Central Nervous System such as: tumors, trauma, vascular disease, infections, degenerative diseases, demyelinating diseases

2. Muscle and peripheral nerve diseases

3.. Relate Neurological, Neurosurgical disease and Neuroradiological findings with Neuropathology.

4. Relate Neuropathological findings to disease elsewhere in the body.

5. Selection of appropriate immunocytochemical, molecular, and other markers to confirm the diagnosis.
III Clinical Research:

At each Hospital a trainee can work-up rare cases for presentation at local, National and International meetings and for publication in peer-reviewed journals. Opportunities also exist for the trainee to partake in translational research projects at each site and basic neuroscience projects at selected sites.

IV Teaching:

1. The formal teaching conducted at each Hospital is shown in the appendix.
2. Enhance presentation effectiveness by showing and describing the relevant clinicopathological correlations and the pathologic evidence for a specific diagnosis at various clinical rounds: pathology, neurology, neuropathology, neurosurgery, neurological science.
3. Self study and self evaluation using archival material and slide collection
4. Access to Medline searches
5. Access to pertinent Neuropathology texts
ROTATION SPECIFIC OBJECTIVES FOR PGY3-PGY5 YEARS

Items listed in bold are objectives that are relatively unique to a given NP rotation, and should be an area of emphasis for the rotation.

I. NEUROPATHOLOGY AT UNIVERSITY HEALTH NETWORK

Emphasis of the rotation will be on neuro-oncology, epilepsy, CNS autopsies (both hospital autopsies and neurodegenerative disorders, especially dementia and movement disorders), electron microscopy, molecular pathology and digital pathology.

MEDICAL EXPERT

1.1 Demonstrate diagnostic and technical skills in neuropathology for ethical and effective patient care

To achieve this, the neuropathology trainee must be competent to:

1.1.1. Obtain relevant clinical, radiologic, neurophysiologic data and use this information for the neuropathologic examination.

1.1.2. Demonstrate an ability to adequately harvest neuropathologic specimens at autopsy, if appropriate for the study of the case and provided that a valid consent is available.

1.1.3 Apply appropriate precautions for both surgical and autopsy cases with conventional infectious etiologies.

1.1.4. Apply appropriate precautions for both surgical and autopsy cases suspected to have a prion etiology.

1.1.5. Demonstrate an ability to cut the brain, spinal cord and other samples taken at autopsy, in a manner appropriate for a given case, with proper written and photographic documentation of findings.

1.1.6. Demonstrate an ability to adequately handle surgical neuropathology specimens, including intra-operative NP consultations.

1.1.7. Demonstrate knowledge and understanding of the methods of tissue fixation and processing in neuropathology.

1.1.9. Demonstrate the ability to adequately describe and record microscopic findings, including verbally, in writing and with photomicrographs.

1.1.10. Demonstrate adequate skill in electron microscopy. For this, the trainee should be able to:

1.1.10.1. Understand the principles of electron microscopy.
1.1.10.2. Operate the electron microscope and take electron micrographs.

1.1.10.3. Have a basic understanding of the maintenance of the electron microscope.

1.1.10.4 Have a basic understanding of trouble-shooting in electron microscopy.

1.1.10.6. Describe ultrastructural findings.

1.1.10.7. Correlate the electron microscopic findings with the gross, light microscopic, clinical, radiologic, neurophysiologic and laboratory data.

1.11 Demonstrate an ability to prepare a neuropathology autopsy report with an interpretation appropriate to the clinical setting, including correlation with clinical course, general autopsy findings, and issue Neuropathologic diagnosis and potential cause of death.

1.1.12. Demonstrate an ability to produce a neuropathology surgical report with an interpretation appropriate to the clinical setting, including the provision of a Neuropathologic diagnosis, clinical correlation, and recommendation of additional investigations.

1.1.13 Demonstrate an ability to use microcomputers.

1.1.14 Demonstrate an ability to run a quality control program in neuropathology. For this, the trainee should be able to:

   1.1.14.1. Participate in a conference with colleagues in the discussion of routine, interesting, and difficult cases.

   1.1.14.2. Be familiar with quality control programs for tissue processing and staining.


1.2.4. Have a general knowledge of the structure and function of the CNS, PNS, ANS and skeletal musculature.

1.2.4.4. the molecular genetics and molecular biology of the brain and spinal cord.

1.2.6. Have a detailed knowledge of the specific disease processes of the CNS, PNS, ANS and muscle. For this the trainee should have knowledge of the molecular
genetics, molecular biology, etiology, pathophysiology, gross and microscopic pathology and clinicopathologic correlations for the following disease categories:

Central Nervous System Diseases
1.2.6.2. The effects of systemic hypoxia and hypotension
1.2.6.3. Diseases involving blood vessels supplying and draining the CNS.
1.2.6.6. The effects of physical agents, including radiation, on the CNS.
1.2.6.8. **Seizure disorders.**
1.2.6.10. Disease processes involving the skull and spinal column, and their secondary effects on the CNS.
1.2.6.11. The effects of systemic diseases on the CNS, including paraneoplastic syndromes.
1.2.6.12. Bacterial, fungal, parasitic, viral, and rickettsial infections of the CNS.
1.2.6.13. Prion diseases of the CNS.
1.2.6.14. **Disease processes which can lead to dementia.**
1.2.6.15. Movement disorders and system degenerations of the CNS.
1.2.6.16. Primary and Metastatic neoplasms of the CNS.

Peripheral nervous system
1.2.7.14. **Neoplasms of peripheral nerve.**

**COMMUNICATOR**

2.3 Discuss neuropathology information freely with clinicians and, if necessary, patients and their families.

*At UHN these communicative opportunities include CNS tumour board, CNS grand rounds, and multi-disciplinary rounds for movement disorders and dementia.*

**COLLABORATOR**

3.1 Collaborate effectively with other physicians and health care professionals.
3.2 Contribute effectively to interdisciplinary team activities.
Unique opportunities to collaborate while at UHN include:

- collaboration with molecular biology team regarding genetics of brain tumours
- collaboration with neuromuscular neurologists regarding the interpretation of neuromuscular biopsies
- collaboration with movement disorder neurologists and fellows and cognitive neurologists regarding neurodegenerative autopsy cases
- collaboration with large group of Anatomical Pathology residents and elective medical students in educational endeavors

MANAGER

4.1 Utilize time and resources effectively to balance patient care, learning needs and outside activities.

4.2 Allocate finite health care resources wisely. To achieve this, the neuropathology trainee must:

4.2.1. Use discretion in ordering special stains and special techniques, to optimize utilization of resources without unnecessary waste.

4.3 Work effectively and efficiently in a health care organization. For this the neuropathology trainee must:

4.3.1. Understand the roles and responsibilities of a laboratory physician in general and a neuropathologist in particular.

4.3.4. Work effectively with other health team professionals, and understand the roles of other individuals in the laboratory including MLTs, PA's and laboratory managers.

4.3.5. Be able to prioritize neuropathology specimens based on clinical urgency.

4.3.6. Understand the principles of a quality assurance program in the laboratory.

4.3.7 Acquire skills in the development of guidelines relevant to the practice of neuropathology.

4.4 Effectively utilize information technology to optimize patient care, continual self-learning, and other activities.

4.5 Learn to use digital pathology as a tool for:

4.5.1 Intra-operative Neuropathology consultation

4.5.2 Education
6.1 Develop, implement and document a personal continuing education strategy
   6.1.4. Evaluate the outcome of the self-learning experience.
   6.1.5. Apply the new knowledge to his/her practice of neuropathology.

- *self study using cases from the Linell collection, brain bank material*

6.3 Facilitate the learning of patients, students, residents and other health professionals.

- *teaching opportunities abound at UHN due to the large group of medical elective students, clinical neuroscience residents and anatomical pathology residents who all require and desire Neuropathology reaching.*

6.4 Contribute to the development of new knowledge. To achieve this, the neuropathology trainee must:
   6.4.1. Develop research skills for individual and collaborative research endeavors in clinical, applied or basic science research in the diseases of the CNS, PNS, ANS or skeletal muscle.

- *opportunities to undertake research projects, especially in neuro-oncology or neuro-degenerative disease*

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**HEALTH ADVOCATE**

5.3 Be familiar with the means of minimizing laboratory error, including laboratory accreditation and quality assurance programs.

   5.3.1 Attend SHSC-UHN Neuropathology consensus rounds.

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**PROFESSIONAL**

7.1 Deliver the highest quality practice of neuropathology with integrity, honesty and compassion. To achieve this, the neuropathology trainee must:

   7.1.2. Continually evaluate his/her abilities, knowledge and skills.

*Self-examination using the Lindell slide collection.*

*Participation in weekly SHSC-UHN consensus rounds.*
II. NEUROPATHOLOGY AT ST MICHAEL’S HOSPITAL

The emphasis will be on neuro-oncology, demyelinating disease, infectious, toxic and nutritional disease of the nervous system, diseases of muscle, and electron microscopy.

MEDICAL EXPERT

1.1 Demonstrate diagnostic and technical skills in neuropathology for ethical and effective patient care
To achieve this, the neuropathology trainee must be competent to:

1.1.1. Obtain relevant clinical, radiologic, neurophysiologic data and use this information for the neuropathologic examination.

1.1.2. Demonstrate an ability to adequately harvest neuropathologic specimens at autopsy, if appropriate for the study of the case and provided that a valid consent is available.

1.1.3. Apply appropriate precautions for both surgical and autopsy cases with conventional infectious etiologies.

1.1.4. Apply appropriate precautions for both surgical and autopsy cases suspected to have a prion etiology.

1.1.5. Demonstrate an ability to cut the brain, spinal cord and other samples taken at autopsy, in a manner appropriate for a given case, with proper written and photographic documentation of findings.

1.1.6. Demonstrate an ability to adequately handle surgical neuropathology specimens, including intra-operative NP consultations.

1.1.9. Demonstrate the ability to adequately describe and record microscopic findings, including verbally, in writing and with photomicrographs.

1.1.10. Demonstrate adequate skill in electron microscopy. For this, the trainee should be able to:

1.1.10.1. Understand the principles of electron microscopy.

1.1.10.2. Operate the electron microscope and take electron micrographs.

1.1.10.3. Have a basic understanding of the maintenance of the electron microscope.

1.1.10.4. Have a basic understanding of trouble-shooting in electron microscopy.

1.1.10.6. Describe ultrastructural findings.
1.1.10.7. Correlate the electron microscopic findings with the gross, light microscopic, clinical, radiologic, neurophysiologic and laboratory data.

1.1.11 Demonstrate an ability to prepare a neuropathology autopsy report with an interpretation appropriate to the clinical setting, including correlation with clinical course, general autopsy findings, and issue Neuropathologic diagnosis and potential cause of death.

1.1.12. Demonstrate an ability to produce a neuropathology surgical report with an interpretation appropriate to the clinical setting, including the provision of a Neuropathologic diagnosis, clinical correlation, and recommendation of additional investigations.

1.1.13 Demonstrate an ability to use current computer programs.

1.2.6. Have a detailed knowledge of the specific disease processes of the CNS, PNS, ANS and muscle. For this the trainee should have knowledge of the molecular genetics, molecular biology, etiology, pathophysiology, gross and microscopic pathology and clinicopathologic correlations for the following disease categories:

Central Nervous System Diseases

1.2.6.1. Trauma.
1.2.6.2. The effects of systemic hypoxia and hypotension
1.2.6.3. Diseases involving blood vessels supplying and draining the CNS.
1.2.6.4. The effects of metabolic and nutritional disorders on the CNS.
1.2.6.5. The effects of toxins and drugs on the CNS.
1.2.6.6. The effects of physical agents, including radiation, on the CNS.
1.2.6.9. Disease processes affecting the pituitary gland, hypothalamus and hypothalamic-pituitary axis.
1.2.6.10. Disease processes involving the skull and spinal column, and their secondary effects on the CNS.
1.2.6.11 The effects of systemic diseases on the CNS, including paraneoplastic syndromes.
1.2.6.12. Bacterial, fungal, parasitic, viral, and rickettsial infections of the CNS.
1.2.6.13. Prion diseases of the CNS.
1.2.6.14. Disease processes which can lead to dementia.
1.2.6.15. Movement disorders & system degenerations of CNS.
1.2.6.16. Primary and Metastatic neoplasms of the CNS.

Muscle Diseases
1.2.9.1. Myopathies and their classification.
1.2.9.2. Disorders of neuromuscular transmission.
1.2.9.3. The effects of motor neuron disorders on skeletal muscles.
1.2.9.4. Dystrophinopathies.
1.2.9.5. Sarcoglycanopathies and other limb girdle muscular dystrophies.
1.2.9.6-13. Non-infectious inflammatory myopathies, infectious, ion channel, mitochondrial, lipid storage, glycogenosis, congenital, and metabolic myopathies.
1.2.9.15. Primary neoplasms of muscle.

COMMUNICATOR

2.3 Discuss information freely with clinicians and, if necessary, patients and their families. For this, the trainee must be able to:

2.3.1 Communicate both verbally and in writing, the results of neuropathology investigations in a time period specified by a given department to clinical colleagues, so that patient care is not delayed or jeopardized.

2.3.2 Understand the basic necessary content and structure of a neuropathology report for autopsy and surgical cases, and compose accurate and succinct pathology reports.

2.3.3 Be able to articulately express a degree of diagnostic uncertainty within a pathology report.

2.3.4 Be willing to discuss results with the family, as they become available and provide a time-line for the final diagnosis.

2.3.5 Be able to present neuropathology findings to non-neuropathologists in intra-departmental and inter-departmental (multi-disciplinary) rounds.
At St Mike's these communicative opportunities include weekly neuro-oncology rounds and weekly neurology rounds.

**COLLABORATOR**

3.1 Collaborate effectively with other physicians and health care professionals.

3.2 Contribute effectively to interdisciplinary team activities.

Unique opportunities to collaborate while at St Mike's include:
- multi-disciplinary 'brain cutting' rounds including clinical neuroscience residents
- collaboration with MS neurologists

**MANAGER**

4.1 Utilize time and resources effectively to balance patient care, learning needs and outside activities.

4.2 Allocate finite health care resources wisely. To achieve this, the neuropathology trainee must:
   4.2.1. Use discretion in ordering special stains and special techniques, to optimize utilization of resources without unnecessary waste.

4.3 Work effectively and efficiently in a health care organization. For this the neuropathology trainee must:

4.4 Effectively utilize information technology to optimize patient care, continual self-learning, and other activities.

**SCHOLAR**

6.1 Develop, implement and document a personal continuing education strategy
   - self study using cases from Dr Munoz's slide collection (close to 1000 cases)

6.3 Facilitate the learning of patients, students, residents and other health professionals.
   - teaching opportunities at St Mike's hinge upon teaching Neuropathology to elective medical students, clinical neuroscience residents and AP residents on the neuropathology service

6.4 Contribute to the development of new knowledge. To achieve this, the neuropathology trainee must:
6.4.1. Develop research skills for individual and collaborative research endeavors in clinical, applied or basic science research in the diseases of the CNS, PNS, ANS or skeletal muscle.

- opportunities to undertake research projects, especially in neuro-degenerative disease, neuro-muscular disease and neuro-oncology

HEALTH ADVOCATE

5.1 Identify the important determinants of health affecting patients, with respect to diseases of the nervous system. To this end, the neuropathology trainee must be able to recognize:

5.1.1- 5. The biological, economic, environmental, psychological and social factors that influence the diseases of the CNS, PNS and skeletal muscles, and incorporate these factors in the pathogenesis of diseases of the nervous system.

5.2. Recognize and respond to those issues, settings, circumstances, or situations in which advocacy on behalf of patients with disorders of the nervous system, or on behalf of professions or society as appropriate. For this the neuropathology trainee must be competent to:

5.2.1. Identify populations at risk for specific disease entities involving the CNS, PNS or skeletal muscle.

*Given its inner-city patient population, NP at St Mike's offers the opportunity for the resident to reflect on determinants of health.*

PROFESSIONAL

7.1 Deliver the highest quality practice of neuropathology with integrity, honesty and compassion. To achieve this, the neuropathology trainee must:

7.1.2. Continually evaluate his/her abilities, knowledge and skills.

*Self-examination using Dr Munoz's slide collection.*
III. NEUROPATHOLOGY AT SUNNYBROOK HEALTH SCIENCES CENTRE

Emphasis will be on CNS autopsies (neurodegenerative including dementia and ALS, hospital autopsies on adult cases, and fetal neuropathology), neuromuscular pathology, and learning laboratory techniques in autopsy and neuromuscular neuropathology.

MEDICAL EXPERT

1.1 Demonstrate diagnostic and technical skills in neuropathology for ethical and effective patient care

To achieve this, the neuropathology trainee must be competent to:

1.1.1. Obtain relevant clinical, radiologic, neurophysiologic data and use this information for the neuropathologic examination.

1.1.2. Demonstrate an ability to adequately harvest neuropathologic specimens at autopsy, if appropriate for the study of the case and provided that a valid consent is available.

1.1.3. Apply appropriate precautions for both surgical and autopsy cases with conventional infectious etiologies.

1.1.4. Apply appropriate precautions for both surgical and autopsy cases suspected to have a prion etiology.

1.1.5. Demonstrate an ability to cut the brain, spinal cord and other samples taken at autopsy, in a manner appropriate for a given case, with proper written and photographic documentation of findings.

1.1.6. Demonstrate an ability to adequately handle surgical neuropathology specimens, including intra-operative NP consultations.

1.1.7. Demonstrate knowledge and understanding of the methods of tissue fixation and processing in neuropathology.

1.1.8. Demonstrate knowledge of the principles of histologic staining and the use of these stains in the examination of diseases of the nervous system. For this the trainee must be able to:

1.1.8.1. Understand the basis of the routine stains and selected special stains

1.1.8.2. Understand the basis of histochemistry

1.1.8.3. Understand the basis of immunohistochemistry

1.1.8.4. Understand the utility of the immunocytochemical stains used in neuropathology
1.1.8.8. Understand the basis of, and be able to do, peripheral nerve fibre teasing techniques

1.1.8.9. Understand the basis of, and be able to do morphometry

1.1.9. Demonstrate the ability to adequately describe and record microscopic findings, including verbally, in writing and with photomicrographs.

1.1.10.7. Correlate the electron microscopic findings with the gross, light microscopic, clinical, radiologic, neurophysiologic and laboratory data.

1.1.11 Demonstrate an ability to prepare a neuropathology autopsy report with an interpretation appropriate to the clinical setting, including correlation with clinical course, general autopsy findings, and issue Neuropathologic diagnosis and potential cause of death.

1.1.12. Demonstrate an ability to produce a neuropathology surgical report with an interpretation appropriate to the clinical setting, including the provision of a Neuropathologic diagnosis, clinical correlation, and recommendation of additional investigations.

1.1.13 Demonstrate an ability to use microcomputers.

1.2.4. Have a general knowledge of the structure and function of the CNS, PNS, ANS and skeletal musculature.

1.2.4.5. the normal gross and microscopic anatomy of the PNS.

1.2.4.6. the neurophysiology of the PNS, and how this relates to the microscopic anatomy.

1.2.4.7. the neurochemistry of axonal transport and action potential propagation.

1.2.4.8. the molecular biology of axons and the neuromuscular junction.

1.2.4.9. normal skeletal muscle gross and microscopic anatomy.

1.2.4.10. the biochemistry of skeletal muscle and its relationship to muscle contraction, and how this relates to the ultrastructure of muscle.

1.2.4.11. the molecular biology of skeletal muscle.

1.2.4.12. the ultrastructural features, physiology, biochemistry and molecular biology of the neuro-muscular junction and how specific perturbations of these lead to specific clinical, physiologic and laboratory abnormalities.

1.2.4.13. the embryologic development of the CNS, PNS and skeletal muscle and its relationship to malformations, the molecular biology and genetics associated with malformations.
1.2.6. Have a detailed knowledge of the *specific disease processes* of the CNS, PNS, ANS and muscle. For this the trainee should have knowledge of the molecular genetics, molecular biology, etiology, pathophysiology, gross and microscopic pathology and clinicopathologic correlations for the following disease categories:

**Central Nervous System Diseases**

1.2.6.1. Trauma.

1.2.6.2. The effects of systemic hypoxia and hypotension

1.2.6.3. Diseases involving blood vessels supplying and draining the CNS.

1.2.6.4. The effects of metabolic and nutritional disorders on the CNS.

1.2.6.5. The effects of toxins and drugs on the CNS.

1.2.6.6. The effects of physical agents, including radiation, on the CNS.

1.2.6.7. *Schizophrenia, manic-depressive psychosis and other psychoses.*

1.2.6.9. Disease processes affecting the pituitary gland, hypothalamus and hypothalamic-pituitary axis.

1.2.6.10. Disease processes involving the skull and spinal column, and their secondary effects on the CNS.

1.2.6.11. The effects of systemic diseases on the CNS, including paraneoplastic syndromes.

1.2.6.12. Bacterial, fungal, parasitic, viral, and rickettsial infections of the CNS.

1.2.6.13. *Prion diseases of the CNS.*

1.2.6.14. Disease processes which can lead to dementia.

1.2.6.15. *Movement disorders & system degenerations of CNS.*

1.2.6.16. Primary and Metastatic neoplasms of the CNS.

1.2.6.18. *Acquired lesions in the perinatal, postnatal and childhood periods* (diseases of grey matter, diseases of white matter, diseases of both grey and white matter, arterial diseases, venous diseases, trauma in utero and postnatally, infection and hemorrhage)
1.2.6.19. Lesions with a genetic basis and those which are associated with syndromes.

1.2.6.20. Congenital malformations of the CNS and their associations.

1.2.6.21. Metabolic diseases which manifest in the fetus, neonate and child (lysosomal storage diseases & peroxisomal diseases).

Peripheral Nervous System Diseases

1.2.7.1. Peripheral neuropathies and their classification.

1.2.7.2.-7. Mechanical, temperature, radiation, nutritional, toxic injury to peripheral nerves.

1.2.7.8. The effects of systemic metabolic diseases on peripheral nerves.

1.2.7.9. The inherited peripheral neuropathies.

1.2.7.10. The inflammatory neuropathies.

1.2.7.11. Neuropathies due to infectious agents.

1.2.7.12. Paraneoplastic neuropathies.

1.2.7.13. The effects of vascular disease (including the vasculitides) on peripheral nerves.

1.2.7.14. Neoplasms of peripheral nerve.

Muscle Diseases

1.2.9.1. Myopathies and their classification.

1.2.9.2. Disorders of neuromuscular transmission.

1.2.9.3. The effects of motor neuron disorders on skeletal muscles.

1.2.9.4. Dystrophinopathies.

1.2.9.5. Sarcoglycanopathies and other limb girdle muscular dystrophies.

1.2.9.6-13. Non-infectious inflammatory myopathies, infectious, ion channel, mitochondrial, lipid storage, glycogenosis, congenital, and metabolic myopathies.


1.2.9.15. Primary neoplasms of muscle.
COMMUNICATOR

2.3 Discuss information freely with clinicians and, if necessary, patients and their families. For this, the trainee must be able to:

2.3.1. Communicate both verbally and in writing, the results of neuropathology investigations in a time period specified by a given department to clinical colleagues, so that patient care is not delayed or jeopardized.

2.3.2 Understand the basic necessary content and structure of a neuropathology report for autopsy and surgical cases, and compose accurate and succinct pathology reports.

2.3.3 Be able to articulately express a degree of diagnostic uncertainty within a pathology report.

2.3.4. Be willing to discuss results with the family, as they become available and provide a time-line for the final diagnosis.

2.3.5 Be able to present neuropathology findings to non-neuropathologists in intra-departmental and inter-departmental (multi-disciplinary) rounds.

At Sunnybrook these communicative opportunities include CNS tumour board and CNS grand rounds.

The content and quality of Neuropathology reports, presentations and verbal diagnoses will be closely monitored and evaluated with the 360 degree evaluation.

COLLABORATOR

3.1 Collaborate effectively with other physicians and health care professionals.

3.2 Contribute effectively to interdisciplinary team activities.

Unique opportunities to collaborate while at Sunnybrook include:
- collaboration with cognitive neurologists, ALS neurologists, and molecular biologists regarding neurodegenerative autopsy cases
- opportunities to collaborate with perinatal pathologist and OB/GYN on fetal neuropathology autopsy cases

MANAGER

4.1 Utilize time and resources effectively to balance patient care, learning needs and outside activities.
4.2 Allocate finite health care resources wisely. To achieve this, the neuropathology trainee must:

4.2.1. Use discretion in ordering special stains and special techniques, to optimize utilization of resources without unnecessary waste.

4.3 Work effectively and efficiently in a health care organization. For this the neuropathology trainee must:

4.3.1. Understand the roles and responsibilities of a laboratory physician in general and a neuropathologist in particular.

4.3.4. Work effectively with other health team professionals, and understand the roles of other individuals in the laboratory including MLTs, PA’s and laboratory managers.

4.3.5. Be able to prioritize neuropathology specimens based on clinical urgency.

4.3.6. Understand the principles of a quality assurance program in the laboratory.

4.3.7 Acquire skills in the development of guidelines relevant to the practice of neuropathology.

4.4 Effectively utilize information technology to optimize patient care, continual self-learning, and other activities.

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**SCHOLAR**

6.1 Develop, implement and document a personal continuing education strategy

- **self study using cases from searchable archive of neurosurgical cases and neuroautopsy cases, focusing on rare diagnoses not yet encountered in neuropathology training**

- **in PGY5 year, self study and self evaluation using slide collection of Dr Bilbao**

6.3 Facilitate the learning of patients, students, residents and other health professionals.

- **teaching opportunities at Sunnybrook hinge upon teaching Neuropathology to elective medical students, clinical residents and AP residents on the neuropathology service**
6.4 Contribute to the development of new knowledge. To achieve this, the neuropathology trainee must:

6.4.1. Develop research skills for individual and collaborative research endeavors in clinical, applied or basic science research in the diseases of the CNS, PNS, ANS or skeletal muscle.

- opportunities to undertake research projects, especially in neuro-muscular and neuro-degenerative disease

HEALTH ADVOCATE

5.3 Be familiar with the means of minimizing laboratory error, including laboratory accreditation and quality assurance programs.

- Attend SHSC-UHN Neuropathology consensus rounds.

PROFESSIONAL

7.1 Deliver the highest quality practice of neuropathology with integrity, honesty and compassion. To achieve this, the neuropathology trainee must:

7.1.1. Use appropriate strategies to maintain and advance professional competence in neuropathology.

Exposure to the British NP Society’s External Quality Assessment Scheme

- Continually evaluate his/her abilities, knowledge and skills.

Self-examination using Dr Bilbao’s slide collection.

- Be aware of personal professional limitations.

- Demonstrate integrity when dealing with colleagues and others.

- Demonstrate honesty in dealing with colleagues and others.

7.2 Exhibit appropriate personal and interpersonal behaviors.

The interpersonal interactions of the NP resident will be evaluated using the 360 degree evaluation.
IV. NEUROPATHOLOGY AT THE HOSPITAL FOR SICK CHILDREN

This rotation provides training in pediatric neuropathology and allows the trainee to gain an understanding of pathologic processes unique to the immature and developing brain. Exposure to molecular biology and pediatric forensic autopsy brains.

MEDICAL EXPERT

1.1.2. Demonstrate an ability to adequately harvest the following neuropathologic specimens at autopsy, if appropriate for the study of the case and provided that a valid consent is available.

1.1.2.2 the brain of a fetus, neonate, infant or child in the most effective manner to demonstrate malformations.

1.2.4. Have a general knowledge of the structure and function of the CNS, PNS, ANS and skeletal musculature.

1.2.4.4. The molecular genetics and molecular biology of the brain and spinal cord.

1.2.4.13. The embryologic development of the CNS, PNS and skeletal muscle and its relationship to malformations, the molecular biology and genetics associated with malformations (ie. neural tube defects, migration disorders, hydrocephalus)

1.2.5. Have a detailed knowledge of the basic cellular reactions of the developing CNS, PNS, ANS and skeletal muscle.

1.2.5.4 The normal and developmental and basic reactions of the CNS during the prenatal, perinatal and childhood periods.

1.2.5.5. The gross, microscopic and physiologic changes associated with increased intracranial pressure, cerebral edema and hydrocephalus.

1.2.6. Have a detailed knowledge of the specific disease processes of the nervous system. For this the trainee should have knowledge of the molecular genetics, molecular biology, etiology, pathophysiology, gross and microscopic pathology and clinicopathologic correlations for the following disease categories (for pediatric patients):

Central Nervous System Diseases

1.2.6.2. The effects of systemic hypoxia and hypotension

1.2.6.3. Diseases involving blood vessels supplying and draining the CNS.
1.2.6.6. The effects of physical agents, including radiation, on the CNS.

1.2.6.8. Seizure disorders.

1.2.6.10. Disease processes involving the skull and spinal column, and their secondary effects on the CNS.

1.2.6.12. Bacterial, fungal, parasitic, viral, and rickettsial infections of the CNS.

1.2.6.16. Primary and Metastatic neoplasms of the CNS.

1.2.6.18. Acquired lesions in the perinatal, postnatal and childhood periods. (Diseases of grey matter, diseases of white matter, diseases of both grey and white matter, arterial diseases, venous diseases, trauma in utero and postnatally, infection and hemorrhage).

1.2.6.19. Lesions with a genetic basis and those which are associated with syndromes.

1.2.6.20. Congenital malformations of the CNS and their associations.

1.2.6.21. Metabolic diseases which manifest in the fetus, neonate and child. (Lysosomal storage diseases and peroxisomal diseases).

1.2.6.22. Degenerative diseases which affect the CNS, PNS, and musculoskeletal system in infants and childhood.

1.2.6.23. Sudden unexpected death in infants.

1.2.6.24. Childhood CNS tumors.

Peripheral Nervous System Diseases

1.2.7.1. Peripheral neuropathies and their classification.

1.2.7.9. The inherited peripheral neuropathies.

1.2.7.14. Neoplasms of peripheral nerve.

Muscle Diseases

1.2.9.1. Myopathies and their classification.

1.2.9.2. Disorders of neuromuscular transmission.

1.2.9.3. The effects of motor neuron disorders on skeletal muscles.
1.2.9.4. Dystrophinopathies.
1.2.9.5. Sarcoglycanopathies and other limb girdle muscular dystrophies.
1.2.9.6-13. Non-infectious inflammatory myopathies, infectious, ion channel, mitochondrial, lipid storage, glycogenosis, congenital, and metabolic myopathies.
1.2.9.15. Primary neoplasms of muscle.

COMMUNICATOR

2.3 Discuss information freely with clinicians and, if necessary, patients and their families. For this, the trainee must be able to:

2.3.1. Communicate both verbally and in writing, the results of neuropathology investigations in a time period specified by a given department to clinical colleagues, so that patient care is not delayed or jeopardized.

2.3.2. Understand the basic necessary content and structure of a neuropathology report for autopsy and surgical cases, and compose accurate and succinct pathology reports.

2.3.3. Be able to articulately express a degree of diagnostic uncertainty within a pathology report.

2.3.4. Be willing to discuss results with the family, as they become available and provide a time-line for the final diagnosis.

2.3.5. Be able to present neuropathology findings to non-neuropathologists in intra-departmental and inter-departmental (multi-disciplinary) rounds.

At Sick Kids these communicative opportunities include CNS tumour board and Pathology slide rounds.

COLLABORATOR

3.1 Collaborate effectively with other physicians and health care professionals.

3.2 Contribute effectively to interdisciplinary team activities.

Unique opportunities to collaborate while at Sick Kids include:
- collaboration with pediatric neurologists, neurosurgeons, pediatric oncologists and radiation oncologists, and molecular biologists regarding pediatric oncology cases
- collaboration with geneticists, neurologists and Anatomic Pathologists regarding developmental autopsy cases
4.1 Utilize time and resources effectively to balance patient care, learning needs and outside activities.

4.2 Allocate finite health care resources wisely. To achieve this, the neuropathology trainee must:
   4.2.1. Use discretion in ordering special stains and special techniques, to optimize utilization of resources without unnecessary waste.

4.3 Work effectively and efficiently in a health care organization. For this the neuropathology trainee must:
   4.3.1. Understand the roles and responsibilities of a laboratory physician in general and a neuropathologist in particular.
   4.3.4. Work effectively with other health team professionals, and understand the roles of other individuals in the laboratory including MLTs, PA’s and laboratory managers.
   - the small size of the neuropathology division and the existence of designated neuropathology technical staff at Sick Kids enables the resident to learn the basis of laboratory techniques in neuropathology and the role of the various team members.
   4.3.5. Be able to prioritize neuropathology specimens based on clinical urgency.

4.5 Learn to use digital pathology as a tool for:
   4.5.1 Intra-operative Neuropathology consultation
   4.5.2 Education

SCHOLAR

6.1 Develop, implement and document a personal continuing education strategy
   6.1.4. Evaluate the outcome of the self-learning experience.
   6.1.5. Apply the new knowledge to his/her practice of neuropathology.
   - self study using cases from the searchable archive, focusing on pediatric entities and rare diagnoses not yet encountered in neuropathology training

6.4 Contribute to the development of new knowledge. To achieve this, the neuropathology trainee must:
6.4.1. Develop research skills for individual and collaborative research endeavors in clinical, applied or basic science research in the diseases of the CNS, PNS, ANS or skeletal muscle.

- opportunity to undertake both translational and basic science research projects, especially in pediatric neuro-oncology
- opportunity to attend Neuroscience Rounds at the Research Institute of Hospital for SickKids.

**HEALTH ADVOCATE**

5.3 Be familiar with the means of minimizing laboratory error, including laboratory accreditation and quality assurance programs.

*Participate in weekly pathology consensus rounds.*

**PROFESSIONAL**

7.1 Deliver the highest quality practice of neuropathology with integrity, honesty and compassion. To achieve this, the neuropathology trainee must:

7.1.2. Continually evaluate his/her abilities, knowledge and skills.

*Self-examination using the searchable archive.*

*Participation in weekly pathology consensus rounds.*

**V. NEUROPATHOLOGY AT MT SINAI HOSPITAL**

*This selective rotation can be undertaken either as a 'core NP' rotation or an elective NP rotation. This rotation provides training in developmental autopsy neuropathology and allows the trainee to gain an understanding of pathologic processes unique to the immature and developing brain, and to correlate CNS autopsy findings with systemic autopsy findings. The focus will be on learning clinically relevant neuroembryology and maldevelopment.*

**MEDICAL EXPERT**

1.1.2. Demonstrate an ability to adequately harvest and adequately fix the following neuropathologic specimens at autopsy, if appropriate for the study of the case and provided that a valid consent is available.
1.1.2.2 the brain, eyes, muscle and spinal cord of a fetus, neonate, infant or child in the most effective manner to demonstrate disease or malformations.

1.2.1. To perform and interpret autopsy and surgical pathology as it relates to the nervous system at a level expected of an Anatomic Pathologist and to integrate general autopsy findings with those in the CNS, PNS and muscle. To achieve this, trainee should have a general knowledge of:

   1.2.1.1. the normal gross anatomy of the fetus and placenta.
   1.2.1.2. the histology of the fetal body organs and placenta.
   1.2.1.3. the physiology of the individual body organs including the placenta.

1.2.2. Demonstrate a general knowledge of the general pathologic reactions of the body organs (general pathology). For this trainee should have a general knowledge of:

   1.2.2.4. genetics and the molecular basis of cell function and dysfunction.
   1.2.2.9. the types of disorders which affect the fetus and neonate

1.2.4. Have a general knowledge of the structure and function of the CNS, PNS, ANS and skeletal musculature.

   1.2.4.4. The molecular genetics and molecular biology of the brain, eyes, skeletal muscle and spinal cord.
   1.2.4.13. The embryologic development of the CNS, PNS and skeletal muscle and its relationship to malformations, the molecular biology and genetics associated with malformations (eg. neural tube defects, migration disorders, hydrocephalus)

1.2.5. Have a detailed knowledge of the basic cellular reactions of the developing CNS, PNS, ANS and skeletal muscle.

   1.2.5.4. The normal developmental and basic reactions of the CNS and skeletal muscle during the prenatal, perinatal and childhood periods.

1.2.6. Have a detailed knowledge of the specific disease processes of the nervous system. For this the trainee should have knowledge of the molecular genetics, molecular
biology, etiology, pathophysiology, gross and microscopic pathology and clinicopathologic correlations for the following disease categories (for pediatric patients):

Central Nervous System Diseases

1.2.6.2. The effects of systemic hypoxia and hypotension
1.2.6.3. Diseases involving blood vessels supplying and draining the CNS.
1.2.6.18. Acquired lesions in the fetal and perinatal periods. (Diseases of grey matter, diseases of white matter, diseases of both grey and white matter, arterial diseases, venous diseases, trauma in utero and postnatally, infection and hemorrhage).
1.2.6.19. Lesions with a genetic basis and those which are associated with syndromes.
1.2.6.20. Congenital malformations of the CNS and their associations.
1.2.6.21. Metabolic diseases which manifest in the fetus. (Lysosomal storage diseases and peroxisomal diseases).
1.2.6.22 Congenital myopathies

COMMUNICATOR

2.3 Discuss information freely with clinicians and, if necessary, patients and their families. For this, the trainee must be able to:

2.3.1. Communicate both verbally and in writing, the results of neuropathology investigations
2.3.2 Understand the basic necessary content and structure of a neuropathology report for autopsy surgical cases, and compose accurate and succinct pathology reports.
2.3.3 Be able to articulately express a degree of diagnostic uncertainty within a pathology report.
2.3.4. Be willing to discuss results with the family, as they become available and provide a time-line for the final diagnosis.
2.3.5 Be able to present neuropathology findings to non-neuropathologists in intra-departmental and inter-departmental (multi-disciplinary) rounds.
COLLABORATOR

3.1 Collaborate effectively with other physicians and health care professionals.

3.2 Contribute effectively to interdisciplinary team activities.

*There are opportunities to collaborate with maternal-fetal medicine experts and geneticists regarding developmental abnormalities and mal developmental syndromes. Formal rounds include perinatal pathology rounds, fetal medicine rounds, morbidity and mortality rounds and forensic pathology rounds.*

MANAGER

4.1 Utilize time and resources effectively to balance patient care, learning needs and outside activities.

4.2 Allocate finite health care resources wisely. To achieve this, the neuropathology trainee must:

4.2.1. Use discretion in ordering special stains and special techniques, to optimize utilization of resources without unnecessary waste.

4.3 Work effectively and efficiently in a health care organization. For this the neuropathology trainee must:

4.3.1. Understand the roles and responsibilities of a laboratory physician in general and a neuropathologist in particular.

4.3.4. Work effectively with other health team professionals, and understand the roles of other individuals in the laboratory including MLTs, PA's and laboratory managers.

SCHOLAR

6.1 Develop, implement and document a personal continuing education strategy


6.1.4. Evaluate the outcome of the self-learning experience.

6.1.5. Apply the new knowledge to his/her practice of neuropathology.

6.4 Contribute to the development of new knowledge. To achieve this, the neuropathology trainee must:

6.4.1. Develop research skills for individual and collaborative research endeavors in clinical, applied or basic science research in the diseases of the CNS, PNS, ANS or skeletal muscle.
Opportunity to undertake both translational and basic science research projects in developmental neuropathology

**HEALTH ADVOCATE**

5.1 Identify the important determinants of health affecting patients, with respect to diseases of the nervous system.

*The focus will be on modifiable risk factors in the prenatal period, such as teratogens, for the development of diseases of the nervous system. The importance of maternal health will be emphasized.*

**VI. ELECTIVES IN NEUROPATHOLOGY RESEARCH**

*These elective rotations can take one of the following forms:*

1. **LONGITUDINAL RESEARCH ELECTIVE**
   - this is a 6 month longitudinal elective that can be undertaken at any point in the PGY2-PGY5 years.
   - one half-day per week will be protected time for research
   - this opportunity is available for residents who have already done significant work on a given project, as evidenced by a published abstract or preliminary data, to enable a resident to finish a specified project.
   - interested residents are encouraged to speak with Dr Cynthia Hawkins, resident research advisor, before formal applications are submitted to Dr George Youssef

2. **6 MONTH INTENSIVE RESEARCH ELECTIVE**
   - this 6 month vertical elective can be undertaken in the PGY4 or PGY5 year.
   - interested residents are encouraged to speak with Dr Cynthia Hawkins, resident research advisor
6.1 Develop, implement and document a personal continuing education strategy
To achieve this, the neuropathology trainee must:
6.1.2. Access personal learning needs.
6.1.3. Choose an appropriate learning method and subject matter(s).
6.1.4. Evaluate the outcome of the self-learning experience.
6.1.5. Apply the new knowledge to his/her practice of neuropathology.

6.2 Apply the principles of critical appraisal to sources of medical information.
To achieve this, the neuropathology trainee must:
6.2.1. Incorporate an attitude of scientific inquiry and the use of evidence into the process of making neuropathologic diagnoses.
6.2.2. Select the appropriate questions to be answered.
6.2.3. Research the literature for answers to the question.
6.2.4. Keep current with the evidence-based literature pertinent to the practice of neuropathology.

6.3 Facilitate the learning of patients, students, residents and other health professionals.
To achieve this, the neuropathology trainee must:
6.3.1. Assist these groups in defining learning needs and goals.
6.3.2. Provide direction to these groups for educational development.
6.3.3. Provide constructive feed-back to these individuals in the learning process.
6.3.4. Teach neuropathologic principles to these groups, at rounds, conferences and other forums.
6.3.5. Apply the principles of adult learning in interactions with students, residents, colleagues and others.

6.4 Contribute to the development of new knowledge.
To achieve this, the neuropathology trainee must:
6.4.1. Develop research skills for individual and collaborative research endeavors in clinical, applied or basic science research in the diseases of the CNS, PNS, ANS or skeletal muscle.

To achieve this, the trainee should be able to:

6.4.1.1. Formulate a research question.

6.4.1.2. Conduct a literature research relevant to the question.

6.4.1.3. Identify, consult and collaborate with experts in the area of the research question.

6.4.1.4. Propose a methodologic approach to answer the question.

6.4.1.5. Carry out the research proposal.

6.4.1.6. Defend and disseminate the results of the research.

6.4.1.7. Identify areas for further research which arise from the results.
NEUROPATHOLOGY TRAINING PROGRAM FOR
ANATOMIC PATHOLOGY RESIDENTS

Neuropathology Rotation Specific Objectives: Anatomical Pathology

Neuropathology is an important subject area for practicing anatomical pathologists. Typically residents perform their neuropathology rotations as an intermediate level resident when they are at the PGY3 or PGY4 level. The following are the goals and objectives of the Neuropathology rotation for anatomical pathology residents.

GOAL
To enhance the resident’s knowledge about the anatomy, development and biology of the normal and diseased nervous system.

GENERAL REQUIREMENTS:
The residents will be expected to participate in numerous activities including autopsies, tissue selection and fixation, brain cutting, microscopic assessment of the nervous system, preparation and assessment of surgical biopsies and preparation of neuropathological reports. Residents will participate in all rounds and teaching sessions planned by the neuropathologists during the rotation.

SPECIFIC REQUIREMENTS:

MEDICAL EXPERT
KNOWLEDGE
-Gain an understanding of the basic processes peculiar to the pathology of the nervous system, such as Wallerian degeneration and regeneration, trans-synaptic degeneration, demyelination, tumours.
-Gain some familiarity with neuropathological research, and with the contributions to neuroscience research made with neuropathological techniques.
SKILLS
-Perform basic dissections of the brain and spinal cord in accordance with standard neuropathologic techniques.
-Appropriately prepare and fix gross and microscopic specimens of the nervous system for further examination.
-Display appropriate use of the light microscope.

COMMUNICATOR:
General Requirements
-Understand the need for cooperation between the anatomical pathologist and neuropathologist in the examination and diagnosis of neuropathological specimens.
-Discuss appropriate information with the health care team.

Specific Requirements
-Communicate effectively with attending neuropathologists and paramedical personnel.
-Contribute toward the preparation of neuropathological reports with attention to clinical-pathological correlation.
-Communicate examination results effectively to referring physicians and the health care team.
-Understand the anatomical pathologist’s and neuropathologist's role in the examination and diagnosis of neuropathological specimens.

COLLABORATOR:
General Requirements
-Understand the role and duties of a neuropathologist.
-Contribute to neuropathological examinations and activities within Pathology laboratory.

Specific Requirements
-Be an active participant in the neuropathological examination of specimens. Show an interest in learning the role and duties of a neuropathologist.
-Provide instruction to medical students and more junior physicians at a level appropriate to their clinical education and professional competence.

MANAGER:
General Requirements
-Work effectively with the attending Neuropathologists and laboratory staff.
-Show respect and caution with neuropathological specimens.
-Utilize information technology and literature resources to optimize understanding of the neuropathological diagnostic process.

Specific Requirements
-Recognize the necessary safety precautions entailed in the examination of tissue specimens removed at surgery and postmortem.
-Show the appropriate respect to neuropathological specimens and results of the neuropathological examination.
-Effectively use time to coordinate participation with diagnostic activities in the laboratory and reading.
-Be punctual.

HEALTH ADVOCATE:

General Requirements
-Be aware of important determinants of health related to neuropathological diagnoses.

Specific Requirements
-Important determinants related to neuropathological diagnoses may include the following:
  - Knowledge of the genetic basis for certain disorders and inheritance pattern.
  - Knowledge of infectious disorders that may require preventive action (e.g. HIV, AIDS-related illnesses, Jacob-Creutzfeld disease).

SCHOLAR:

General Requirements
-Develop, implement and monitor a personal continuing education strategy.
-Critically appraise sources of medical information.
NEUROPATHOLOGY TRAINING PROGRAM FOR NEURORSURGERY RESIDENTS

Objectives

Neuropathology is an important subject area for practicing neurosurgeons. Accordingly, residents in the neurosurgery training program at the University of Toronto must undertake at least a 3 month rotation on a neuropathology service at Toronto General Hospital/Toronto Western Hospital, the Hospital for Sick Children, St Michael's Hospital or Sunnybrook Health Sciences Centre. Typically residents perform their neuropathology residents as an intermediate level resident following their first two clinical rotations in neurosurgery when they are at the PGY3 or PGY4 level. The following are the goals and objectives of the Neuropathology rotation for neurosurgery residents.

GOAL

To enhance the resident's knowledge about the anatomy, development and biology of the normal and diseased nervous system.

GENERAL REQUIREMENTS:

The residents will be expected to participate in numerous activities including autopsies, tissue selection and fixation, brain cutting, microscopic assessment of the nervous system, preparation and assessment of surgical biopsies and preparation of neuropathological reports. Residents will participate in all rounds and teaching sessions planned by the neuropathologists during the rotation.
SPECIFIC REQUIREMENTS:

MEDICAL EXPERT/CLINICAL DECISION MAKER

KNOWLEDGE

- Gain an understanding of the basic pathological processes (general pathology).
- Gain an understanding of the basic processes peculiar to the pathology of the nervous system, such as Wallerian degeneration and regeneration, trans-synaptic degeneration, demyelination, tumours.
- Learn the anatomy and functions of the regions, tracts and nuclei of the CNS, taking advantage of the material at hand for brain-cutting and anatomic dissection.
- Learn to recognize and interpret evidence of gross and microscopic disease of the nervous system, and acquire an understanding of the causes and mechanisms of the changes.
- Learn to correlate clinical and pathological findings related to the nervous system, and to relate these to findings in other systems.
- Become familiar with basic neuropathological and neuroanatomic texts, and learn to locate and analyze pertinent literature.
- Gain an appreciation for the diagnostic contribution made by the neuropathologist, and for the factors which may limit this contribution in some situations. e.g. the problems of small specimens or sampling error in the assessment of tumours.
- Gain some familiarity with neuropathological research, and with the contributions to neurosurgical research made with neuropathological techniques.
SKILLS

- Perform basic dissections of the brain and spinal cord in accordance with standard neuropathologic techniques.
- Appropriately prepare and fix gross and microscopic specimens of the nervous system for further examination.
- Display appropriate use of the light microscope.

COMMUNICATOR:

General Requirements

- Understand the need for cooperation between the neurologist and neuropathologist in the examination and diagnosis of neuropathological specimens.
- Discuss appropriate information with the health care team.

Specific Requirements

- Communicate effectively with attending neuropathologists and paramedical personnel.
- Contribute toward the preparation of neuropathological reports with attention to clinical-pathological correlation.
- Communicate examination results effectively to referring physicians and the health care team.
• Understand the neurosurgeon's and neuropathologist's role in the examination and diagnosis of neuropathological specimens.

COLLABORATOR:

General Requirements

• Understand the role and duties of a neuropathologist.
• Contribute to neuropathological examinations and activities within Pathology laboratory.
• Contribute effectively to other interdisciplinary team activities.

Specific Requirements

• Be an active participant in the neuropathological examination of specimens, including the facilitation of clinico-pathologic correlation, where appropriate.
• Show an interest in learning the role and duties of a neuropathologist.
• Provide instruction to medical students and more junior physicians at a level appropriate to their clinical education and professional competence.

MANAGER:

General Requirements

• Work effectively with the attending Neuropathologists and laboratory staff.
• Show respect and caution with neuropathological specimens.
• Utilize information technology and literature resources to optimize understanding of the neuropathological diagnostic process.
**Specific Requirements**

- Recognize the necessary safety precautions entailed in the examination of tissue specimens removed at surgery and postmortem.
- Show the appropriate respect to neuropathological specimens and results of the neuropathological examination.
- Effectively use time to coordinate participation with diagnostic activities in the laboratory and reading.
- Learn the appropriate indications and diagnostic yield of certain sampling techniques, such as brain biopsy.
- Learn the appropriate indications for a 'rush' designation within the laboratory.
- Learn the scenarios in which intra-operative pathology consultation is inappropriate.

**HEALTH ADVOCATE:**

**General Requirements**

- Be aware of important determinants of health related to neuropathological diagnoses.

**Specific Requirements**

- Important determinants related to neuropathological diagnoses may include the following:
  - the genetic basis for certain disorders and inheritance pattern.
  - infectious disorders that may require preventive action (e.g. HIV, AIDS-related illnesses, CJD).
  - the modifiable risk factors in the development of cerebrovascular disease.
o the effect of common toxins, such as alcohol, on the nervous system

**SCHOLAR:**

**General Requirements**

- Develop, implement and monitor a personal continuing education strategy.
- Critically appraise sources of medical information.
- Facilitate learning of patients, house staff/students and other health professionals.

**Specific Requirements**

- Read widely during the Neuropathology rotation especially around cases from clinical neurosurgery services where neuropathology is involved.
- Be able to critically assess the neurosurgical literature as it relates to neuropathological diagnoses and methods.
- Participate in academic activities where available during the Neuropathology rotation such as neuropathology conferences, brain cutting, and neurosciences seminars.

**PROFESSIONAL:**

**General Requirements**

- Exhibit appropriate personal and interpersonal professional behaviors.
- Practice medicine ethically consistent with obligations of a physician.
Specific Requirements

- Be willing and able to appraise accurately his/her own professional performances and show that he/she recognizes his/her own limitations with regard to skill and knowledge by appropriately consulting other physicians and paramedical personnel.
- Be willing and able to expand on one's knowledge base through reading and other resources.
- Actively participate in conferences offered through the Neuropathology division.
- Be punctual
- Be reliably present within the pathology department and respond promptly to pages or other forms of communication from laboratory staff and neuropathologists.
NEUROPATHOLOGY TRAINING PROGRAM
FOR NEUROLOGY TRAINEES

During a three to six month elective training period, the resident will become familiar with the gross and microscopic pathology of the nervous system in health and in disease, thus leading to an understanding of pathogenesis and clinico-pathologic correlation as it relates to common neurologic disease.

OBJECTIVES

Medical Expert

1. The neurology trainee will have the opportunity to strengthen knowledge of neuro-anatomy by participating in the gross (brain cutting) and microscopic examination of the normal brain and spinal cord.

1.1. The trainee will be able to demonstrate familiarity with the normal structure of the nervous system, including:

a. coverings of the CNS,

b. vasculature of the nervous system including major arteries and venous drainage system

c. gyral and sulcal anatomy,

d. location and pathways of cranial nerves,

e. gross and microscopic cross-sectional anatomy of the cerebral hemispheres, basal ganglia, thalamus, brainstem and cerebellum

f. gross and microscopic anatomy of the spinal cord, including relevant tracts and nuclei at different levels,

g. microscopic organization and components of peripheral nerve from spinal roots to muscle and sensory receptors,

h. histochemistry and electron microscopic structure of skeletal muscle.

1.2. The trainee will be able to understand selected standard laboratory methods including:

a. removal of brain from a cadaver

b. selection of appropriate brain sections for microscopic study,

b. preparation of tissue smears and frozen sections for quick examination,

d. the following histochemical and immunohistochemical stains:

H&E, PAS, HPS, Gomori Trichrome, Bielchowsky, Sudan Red, Congo Red, Marchi, Grimelius, GFAP, S 100, EMA (Epithelial Membrane Antigen), Vimentin, factor VIII, LCA (Lymphocyte Common Antigen).
2. The neurology trainee will develop an understanding of the pathogenesis of systemic disease processes as they affect the nervous system, i.e., hypertension, diabetes, atherosclerosis, renal or hepatic failure, vitamin deficiency, infection and cancer.

2.1. The trainee will be able to discuss pathological aspects of vascular and ischemic diseases of the nervous system including:

a. gross and microscopic anatomy of large vessel atheromatous plaques, small vessel lipohyalinosis, berry aneurysms, vascular malformations of brain and spinal cord, vasculitis, venous sinus thrombosis, hypertensive hemorrhage, amyloid angiopathy,

b. mechanisms of disease production,

c. sequelae of focal and global cerebral ischemic insults with temporal evolution and selective vulnerability.

2.2. The trainee will be able to identify and discuss gross and microscopic features and mechanisms by which disease is produced by infectious agents including: HIV, H.Simplex, CMV, PML, measles, bacterial meningitis and abscess, TB, syphilis aspergillosis, cryptococcosis, CJD.

3. The neurology trainee will develop an understanding of the pathogenesis and pathologic features of primary central nervous system disorders including the major neurodegenerative diseases and dementia.

3.1. The trainee will be able to discuss the topographic distribution, characteristic microscopic features, and current theories of pathogenesis for:

a. multiple sclerosis,

b. Alzheimer’s, Pick’s, Huntingtons, Parkinsons and cortical Lewy body diseases, corticobasal ganglionic degeneration, PSP and other multiple system degenerations,

c. spinocerebellar degenerations,

d. motor neuron disease.

4. The neurology trainee will become familiar with the basic histopathologic features of common neuropathic and myopathic processes.

4.1. The trainee will be able to discuss characteristic pathological features and theories of pathogenesis of the following neuromuscular diseases:

a. hereditary sensory and motor neuropathies,

b. inflammatory demyelinating neuropathies,

c. diabetic neuropathies,

d. inflammatory diseases of muscle,
5. The neurology trainee will become familiar with surgical pathology of the central nervous system and its coverings.

5.1. The trainee will gain an understanding of neoplasia of the nervous system and be able to discuss:
   a. embryogenesis of elements of the nervous system,
   b. a classification of tumors based on embryogenesis,
   c. gross, histochemical and immunohistological features of the following tumors:
      astrocytoma, oligodendroglioma, ependymoma, choroid plexus papilloma, glioblastoma multiforme, meningioma, chordoma, hemangioblastoma, paraganglioma, medulloblastoma, metastatic carcinoma, lymphoma, schwannoma, neurofibroma

5.2. The trainee will be able to discuss the relevant pathology of head injury, including:
   a. coup and contra-coup injury, b. diffuse axonal damage.

5.3. The trainee will be able to discuss the relevant pathology of congenital lesions including:
   a. Chiari malformation and associated abnormalities.
   b. Dandy Walker malformation,
   c. spinal dysraphism.

**Communicator**

1. Learn the basic structure and content of a neuropathology diagnostic report.

2. Obtain, summarize and present relevant clinical neuroscience history on surgical and autopsy cases to neuropathologist.

**Collaboration**

1. The trainee will develop an appreciation for the role of the neuropathologist in multidisciplinary patient management teams, including neuromuscular patients and CNS tumour patients.

2. The trainee will appreciate the importance of collaboration between neurologists and neuropathologists in patient care, education and research.
3. The trainee will be respectful and mindful of the roles played by various laboratory personnel, and will collaborate with laboratory staff in a professional manner.

**Manager**

1. The trainee will understand the basic principles behind selected standard laboratory techniques including:
   - grossing, fixation, embedding, microtomy, routine staining, special staining, immunohistochemistry, electron microscopy and molecular diagnostic techniques.
2. The trainee will appreciate how to prioritize neuropathology specimens based on clinical urgency and specimen type, and will appreciate the steps and required turn-around time for generation of a neuropathology diagnostic report.
3. The trainee will understand the importance of using laboratory services prudently.

**Scholar**

1. The neurology trainee will have exposure to, and opportunity to participate in, ongoing departmental research activities.
2. The trainee should become aware of the most influential neuropathology journals.
3. The trainee should understand the role of neuropathologists in neurology research.
4. The trainee will be able to obtain and critically analyze medical literature.

**Professional**

1. The residents will exhibit professional and respectful behavior within the pathology department, including:
   a) being willing and able to appraise accurately their own professional performances and show that they recognize their own limitations with regard to skill and knowledge by appropriately consulting other physicians and paramedical personnel
   b) be willing and able to expand on one's knowledge base through reading and other resources.
   c) actively participate in rounds and educational opportunities conferences offered during their rotation
   d) be punctual and reliably present within the pathology department and respond promptly to communication from laboratory staff and neuropathologists
These objectives will be achieved by:

1. a rotation in neuropathology of at least three months duration

2. participation in postmortem examinations limited to neural structures or general autopsies for patients dying of neurological diseases, under the supervision of a neuropathologist

3. participation in brain cutting and microscopic review of neurologic cases to enhance the trainees knowledge of neuroanatomy and to learn the gross pathological and histological features of disorders of the nervous system;

4. building an adequate knowledge base through the above measures and by utilization of the appended reading list.

Residents will be evaluated at the end of the neuropathology rotation by means of the POWER system
EVALUATION METHODS IN NEUROPATHOLOGY RESIDENCY

1. RESIDENT IN-TRAINING EVALUATION REPORT IN NEUROPATHOLOGY (ITER)

PREAMBLE

The resident in-training evaluation form details the areas of resident performance to be evaluated. It is designed to give a more accurate and explicit assessment of a resident’s performance. Below is a guideline for the keys used in the form.

UNSATISFACTORY

Performance is unacceptable in all areas or resident is performing very badly in several areas. Major improvement is expected or dismissal from the program will follow. Remediation is offered.

BORDERLINE

Performance is below that expected for the level of training in one or two areas. Remediation is indicated. If improvement is not demonstrated probation may be considered.

SATISFACTORY

Performance is as expected for the level of training. The majority of residents should fall in this category.

VERY GOOD

Performance is above that expected for the level of training and is clearly superior to that of one’s peers.

EXCELLENT

Very few residents will fall into this category. Performance is exceptional/outstanding.

Please see appendix for an example of Neuropathology ITER

2. IN-TRAINING EXAMINATION

Based on academic half-day curriculum. 3 written exams per year, at least 2 questions on each addressing non-medical expert CanMEDS roles.

3. PRESENTATIONS AT ROUNDS, ACADEMIC HALF-DAY, CITY-WIDE NEUROPATHOLOGY ROUNDS

Feedback on presentations will be given by supervising staff, and reviewed by RTC every meeting.
4. RESIDENCY PORTFOLIO

Portfolios will be reviewed at every regular Program-Director-Resident review session. Please see appendix for NP residency portfolio.

APPEALS PROCESS

Residents who wish to appeal a promotions decision by the RPC are advised to follow the PGME appeal's process which can be found at:
http://www.governingcouncil.utoronto.ca/policies/appeal.htm

Resident Safety Policy in Neuropathology

General Health and Safety Guidelines for all U of T residents
The Postgraduate Medical Education (PGME) Office developed the PGME Resident Health and Safety Guidelines in March 2009. The Guidelines are available on the website at:

These Guidelines apply to all Residents, including Neuropathology residents. The University, hospitals and affiliated teaching sites are accountable for the environmental, occupational, and personal health and safety of their employees.
In addition, all teaching sites must meet the requirements of the PAIRO-CAHO collective agreement. Residents must adhere to the relevant health and safety policies of each rotation’s training site. The PGME Guideline sets out reporting procedures where there has been or may be a personal safety or security breach, which may include reports to the immediate supervisor at the training site, Program Director, and/or Director, Resident Wellness. Urgent Resident safety issues will be brought to the attention of the Vice-Dean PGME as well as the relevant hospital Vice President Education as appropriate.

Additional Health and Safety Guidelines for Neuropathology Residents
There are several resident safety issues that are relatively unique to neuropathology. These include handling of potentially infectious human tissue (including neurosurgical specimens at the time of intra-operative consultation and CNS autopsy tissue), handling of sharps (including scalpels and larger blades), and exposure to a limited number of chemicals (especially formalin). The resident is directed to review the following resources:

i) The Laboratory Safety Manual at the site of each rotation's pathology department.
The most relevant chapters of the Laboratory Safety Manual are:
- good laboratory safety practices
- personal protective equipment
- general chemical safety
- WHMIS (Workplace Hazardous Materials Information System)
ii) The Material Safety Data Sheet (MSDS) for formalin


Intimidation and harassment will not be tolerated in the residency program. Any issues regarding potential intimidation and harassment should be brought to the attention of Dr Keith and/or the chief neuropathology resident. Alternatively, if a resident wishes to report potential intimidation and harassment to someone outside of the Neuropathology group, they are encouraged to contact Dr Simon Raphael (residency program director for Anatomical Pathology).

** Please note that resources (iii) and (iv) will be reviewed at an academic half day session dedicated to safe handling of potentially infectious CNS tissue.

Neuropathology Postgraduate Education Committee
Terms of Reference
All of the Neuropathology faculty members at the 4 major teaching sites and Mt Sinai hospital are members of the RPC, as is one resident representative who is elected by their peers. Each meeting has a pre-circulated agenda, including several standing agenda items such as ‘resident business’ where the elected resident representative voices resident concerns and questions, and each RPC member has the opportunity to add items to the agenda. Important decisions are decided by vote with each member having one vote. Subcommittees are formed on an ad-hoc basis.

The committee meets 3-4 times/year to discuss and organize:
(i) The overall content of the program
(ii) Proposed changes to the program
(iii) Resident rotations
(iv) Resident evaluations of teaching and individual rotations
(v) Evaluations of residents including ITERS, in-training examination results, performance at city-wide Neuropathology rounds (especially on the ‘hot-seat’ at Slide Club), portfolio and 360° evaluation
(vi) Remedial action for Residents if required
(vii) Other matters related to Residents as they arise
(viii) Admissions to the program
Useful resources in Neuropathology

Neuropathology associations:
- Canadian association of Neuropathologists (www.canp.ca)
- American association of Neuropathologists (www.neuropath.org)
- British Neuropathological Society (www.bns.org.uk)
- International Society of Neuropathology (www.intsocneuropathol.com)

Educational Resources:
- http://neuromuscular.wustl.edu for Neuromuscular pathology

Neuropathology Job Postings
- http://neuropathologyblog.blogspot.ca
- www.pathologyoutlines.com
Appendix

I. NEUROPATHOLOGY RESIDENCY PORTFOLIO

To be completed by the resident and discussed with the program director at regular meetings every 6 months

**MEDICAL EXPERT**

Core principles:
-to be a competent neuropathologist the resident must gain sufficient knowledge of the nervous system and diseases of the nervous system, as outlined in the residency training handbook

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<thead>
<tr>
<th>Mandatory</th>
<th>Dates</th>
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<tbody>
<tr>
<td>Attend and participate in NP academic half day</td>
<td>Weekly, Wednesday 2 - 3:30 or 4</td>
</tr>
<tr>
<td>Attend and participate in city-wide NP rounds</td>
<td>Weekly, Wednesday 3:30 or 4 - 5</td>
</tr>
<tr>
<td>Written quizzes on Neuroanatomy, Neurophysiology, Neuroembryology, and Neuropathology</td>
<td>at least 3 per year</td>
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<tr>
<td>NP OSCE</td>
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<td>NP practice exams using images &amp; glass slides</td>
<td>at least 2 per year in PGY4 and PGY5</td>
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<tr>
<td>Attendance at CNS grand rounds at site of NP rotations</td>
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<td>Attendance at selected AP academic half day sessions</td>
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<tr>
<td>Read recommended Textbooks on Neuroanatomy, Neuroembryology, Neurophysiology, and Neuropathology, as outlined in academic half-day curriculum</td>
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<tr>
<td>Read widely around Neuropathology cases</td>
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<td>Be familiar with the best Neuropathology journals and read these frequently, including all review articles in years leading up to RCPSC examination</td>
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**MANAGER**

Core principles:
- learn the role of a neuropathologist in the organization of a large academic pathology department, including but not limited to:
  - leadership and stewardship skills
  - QA mechanisms
  - innovation and validation of new forms of ancillary testing
  - prudent use of laboratory services
  - prioritisation of neuropathology specimens
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<thead>
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<th>Dates</th>
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<tr>
<td>AP academic half day: &quot;pathology informatics&quot;</td>
<td>May 2\textsuperscript{nd}, 2011</td>
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<tr>
<td>AP academic half day &quot;Lab regulation in Canada&quot;</td>
<td>June 20\textsuperscript{th}, 2011</td>
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<tr>
<td>AP academic half day &quot;QA&quot;</td>
<td>June 6\textsuperscript{th}, 2011</td>
</tr>
<tr>
<td>AP academic half day &quot;tools of the trade: pathology imaging&quot;</td>
<td>May 7\textsuperscript{th}, 2012</td>
</tr>
<tr>
<td>AP academic half day &quot;Pathology and pathologists in epidemics&quot;</td>
<td>June 4\textsuperscript{th}, 2012</td>
</tr>
<tr>
<td>AP academic half day &quot;immunopathology&quot;</td>
<td>June 11\textsuperscript{th}, 2012</td>
</tr>
<tr>
<td>AP academic half day &quot;medico-legal issues in pathology&quot;</td>
<td>June 18\textsuperscript{th}, 2012</td>
</tr>
<tr>
<td>Ap academic half days on forensic pathology</td>
<td>Nov 14\textsuperscript{th} and 28\textsuperscript{th}, 2011</td>
</tr>
<tr>
<td>AP academic half day &quot;lab management I and II&quot;</td>
<td>April 4, 2011</td>
</tr>
<tr>
<td>Perform a QA activity and present at NP academic half-day 360° evaluation</td>
<td></td>
</tr>
<tr>
<td>NP academic half day – 'indications and yield of selected NP sampling techniques'</td>
<td></td>
</tr>
<tr>
<td>NP academic half day &quot;molecular biology techniques for neuropathology&quot;</td>
<td>Spring 2012</td>
</tr>
<tr>
<td>NP academic half day &quot;Safety in the NP lab&quot;</td>
<td>Fall 2012</td>
</tr>
<tr>
<td>Senior NP resident role – scheduling NP academic half day and rounds</td>
<td></td>
</tr>
<tr>
<td>PGCoreED module – 'resident as manager'</td>
<td></td>
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<tr>
<td>Reflection paper on 'errors in Neuropathology'</td>
<td></td>
</tr>
<tr>
<td>CanMEDS online enrichment course for LMP: &quot;Managing adverse patient outcomes&quot;</td>
<td></td>
</tr>
<tr>
<td>CanMEDS online enrichment course for LMP: &quot;Managing conflict&quot;</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Optional but recommended</th>
<th>Dates</th>
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</thead>
<tbody>
<tr>
<td>Chief resident leadership workshop, PGME</td>
<td></td>
</tr>
<tr>
<td>Participate in the development of new immunohistochemical test</td>
<td></td>
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<tr>
<td>Participate in a QA committee</td>
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<tr>
<td>Present CNS grand rounds on a NP QA topic</td>
<td></td>
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<tr>
<td>Chief resident workshop, RCPSC</td>
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</table>
HEALTH ADVOCATE

Core principles:
-in pathology health advocacy hinges upon regulation of lab standards, provision of adequate diagnostic services, and the detection and minimization of diagnostic error
-know the modifiable risk factors for diseases of the nervous system, and be aware of and when appropriate participate in opportunities to increase public awareness of these factors
- recognize that the majority of treatment decisions are based on laboratory results, so be aware of the significant impact that laboratory medicine has on patient health

<table>
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<tr>
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<tbody>
<tr>
<td>AP academic half day &quot;QA&quot;</td>
<td>June 6th, 2011</td>
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<tr>
<td>AP academic half day &quot;Pathology and pathologists in epidemics&quot;</td>
<td>June 4th, 2012</td>
</tr>
<tr>
<td>AP academic half day &quot;update on HIV&quot;</td>
<td>May 14th, 2012</td>
</tr>
<tr>
<td>AP academic half day &quot;medico-legal issues in surgical and general pathology&quot;</td>
<td>June 18th, 2012</td>
</tr>
<tr>
<td>Presentation of 'interesting case rounds with error' at city-wide NP rounds</td>
<td></td>
</tr>
<tr>
<td>Perform a QA activity and present at NP academic half-day</td>
<td></td>
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<tr>
<td>AP academic half day &quot;Lab regulation in Canada&quot;</td>
<td>June 20th, 2011</td>
</tr>
<tr>
<td>NP academic half day &quot;safe handling of infectious NP cases&quot;</td>
<td></td>
</tr>
<tr>
<td>U of T NP day &quot;Chronic traumatic encephalopathy&quot;</td>
<td>November 23, 2011</td>
</tr>
<tr>
<td>PGCareED module 'resident as advocate'</td>
<td></td>
</tr>
<tr>
<td>AP academic half day &quot;epidemiology in clinical research&quot;</td>
<td>April 11, 2011</td>
</tr>
<tr>
<td>Attend NP case consensus rounds (UHN-SHSC)</td>
<td>Weekly during NP rotation at SHSC or UHN</td>
</tr>
<tr>
<td>CanMEDS online enrichment course for LMP: &quot;Managing adverse patient outcomes&quot;</td>
<td></td>
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<tr>
<td>CanMEDS online enrichment course for LMP: &quot;Investigating adverse events&quot;</td>
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<table>
<thead>
<tr>
<th>Optional but recommended</th>
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<tbody>
<tr>
<td>Attend Morbidity and Mortality Rounds</td>
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<tr>
<td>Join lab associations such as CAP, USCAP, or CANP which, as part of their mandate, are advocates for patient health and safety</td>
<td></td>
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<tr>
<td>Be a member of a QA committee</td>
<td></td>
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<tr>
<td>Be involved in the development of departmental policy with regards to patient or worker safety</td>
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<tr>
<td>Attend CANP 2011 symposium on Demyelinating diseases (&quot;CCVSI: the perfect storm&quot;)</td>
<td>September 2011</td>
</tr>
<tr>
<td>Read &quot;USCAP SHORT COURSE #67 — The Anatomic Pathologist's Role in Error Reduction and Patient Safety&quot;</td>
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</table>
Core principles
- NP is an academic specialty and learning to develop, conduct, and present research is an important component of training-critical appraisal of NP literature is a critical skill

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<tr>
<td>Presentation of abstract or unknown case at CANP</td>
<td>At least once during residency</td>
</tr>
<tr>
<td>Attendance of NP journal club</td>
<td>Every 3 months</td>
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<tr>
<td>Presentation of NP journal club</td>
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</table>

Publications

<table>
<thead>
<tr>
<th>Mandatory</th>
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</thead>
<tbody>
<tr>
<td>AP academic half day &quot;bioethics I and II&quot;</td>
<td>March 14th and June 27th, 2011</td>
</tr>
<tr>
<td>AP academic half day &quot;biostats for physicians&quot;</td>
<td>April 11, 2011</td>
</tr>
<tr>
<td>AP academic half day &quot;epidemiology in clinical research&quot;</td>
<td>April 11, 2011</td>
</tr>
<tr>
<td>Presentation at LMP resident research day</td>
<td>At least once during residency</td>
</tr>
<tr>
<td>CanMEDS online enrichment course for LMP: &quot;How to present at meetings and rounds&quot;</td>
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<tr>
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<tbody>
<tr>
<td>Undertake a translational research project with clinical colleagues</td>
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<tr>
<td>Undertake a basic neuroscience research project with basic science colleagues</td>
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<tr>
<td>Be a reviewer of a journal article</td>
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<tr>
<td>Participate in writing or reviewing a chapter for a neuropathology textbook</td>
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<tr>
<td>Participate in writing a review article on a neuropathology subject</td>
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<tr>
<td>Poster presentation at national or international conference (ie. AANP, CCNS, USCAP, CAP)</td>
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<tr>
<td>Read &quot;RCPSC Executive Summary on Research Ethics&quot;</td>
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<tr>
<td>Participate in the organization of LMP resident research day</td>
<td></td>
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</tbody>
</table>
PROFESSIONAL

Core principles:
-the neuropathology resident must exhibit all aspects of professional conduct, as outlined by the CMA, and must appreciate and embrace the aspects of professionalism that uniquely apply to neuropathology.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>AP academic half day &quot;Bioethics I and II&quot;</td>
<td>March 14th and June 27th, 2011</td>
</tr>
<tr>
<td>360° evaluation</td>
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<tr>
<td>PGCoreED module 'resident as professional'</td>
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<td>CanMEDS online enrichment course for LMP: &quot;Managing conflict&quot;</td>
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<tr>
<td>PGME Chief resident workshop on conflict resolution</td>
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<tr>
<td>Complete RCPSC &quot;Bioethics self assessment modules&quot;</td>
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<tr>
<td>Read RCPSC &quot;Executive summary on Conflict Resolution&quot;</td>
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<tr>
<td>Read RCPSC &quot;Executive Summary on Legal Regulation of the Physician-Patient Relationship&quot;</td>
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</table>

COMMUNICATOR

Core principles:
- communicate neuropathology results effectively in writing via pathology reports
- communicate neuropathology results effectively via case presentations to colleagues (neuropathologists and clinical colleagues)
- interact effectively with other colleagues (lab personnel, trainees, staff pathologists)
- be an active participant in group learning activities
- interact effectively with patients and families, when indicated

<table>
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<tr>
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<tbody>
<tr>
<td>Presentation of NP cases at:</td>
<td></td>
</tr>
<tr>
<td>i) Anatomical Pathology intra-departmental rounds</td>
<td></td>
</tr>
<tr>
<td>ii) Multidisciplinary neuro-oncology rounds</td>
<td></td>
</tr>
<tr>
<td>iii) City-wide neuropathology rounds</td>
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<tr>
<td>iv) CNS grand rounds</td>
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<tr>
<td>360° evaluation</td>
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</tr>
<tr>
<td>Presentation of abstract or unknown case at CANP</td>
<td>At least once during residency</td>
</tr>
<tr>
<td>PGCoreED modules: Communicator I &amp; Communicator II</td>
<td></td>
</tr>
</tbody>
</table>

91
Read "Valenstein, PN. Formatting pathology reports: applying 4design principles to improve communication and patient safety. Arch Pathol Lab Med 132: 84-94"

| Teaching other NP residents at NP academic half-day |
| CanMEDS online enrichment course for LMP: "How to present at meetings and rounds" |
| CanMEDS online enrichment course for LMP: "Writing reports and synoptics" |

### COLLABORATOR

**Core principles:**

The neuropathology resident must:

- be an engaged and effective member of patient care team
  - interact with clinical colleagues as needed to optimize the quality of diagnostic services
  - participate in multi-disciplinary patient care meetings
- be an active participant in group learning activities
- be an active participant in a research activity

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<tr>
<td>iv) CNS grand rounds</td>
<td></td>
</tr>
<tr>
<td>PGcoreEd module: 'resident as collaborator'</td>
<td></td>
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<tr>
<td>PGcoreEd module: 'resident as learner and teacher'</td>
<td></td>
</tr>
<tr>
<td>Teaching other NP residents at NP academic half-day</td>
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<td>Attend NP case consensus rounds (UHN-SHSC)</td>
<td>Weekly when on NP rotation at SHSC or UHN.</td>
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<tbody>
<tr>
<td>Participation in city-wide neuro-oncology rounds</td>
<td></td>
</tr>
<tr>
<td>Undertake a translational research project with clinical colleagues</td>
<td></td>
</tr>
<tr>
<td>Undertake a basic neuroscience research project with basic science colleagues</td>
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</tbody>
</table>