CCMG Molecular Genetics Training Guideline and Specialty Requirements

Preamble
The aim of the Molecular Genetics Training Program is to produce scientific specialists with the competence to effectively apply molecular diagnostic testing for disease diagnosis. Competence implies the individual has the knowledge, skills and attitudes to:
1) Identify and interpret molecular abnormalities.
2) Participate in the management of patients and their families with molecular genetic disorders.
3) Assume the day-to-day responsibilities for the operation and standards of a molecular genetics diagnostic laboratory.

The Molecular Geneticist will have a thorough grounding in the theory, methodology and techniques of human molecular genetics, and will be familiar with a broad spectrum of disorders representing all modes of inheritance and indications typically encountered in the molecular diagnostic setting.

Trainees are expected to participate fully in all aspects of laboratory medicine as it relates to molecular genetics, multi-disciplinary case discussion, rounds, seminars and meetings related to molecular genetics. There is increasing responsibility over the 2 year training period to include more independence in result interpretation, test development, lab management, quality assurance and other competencies as outlined here in the Training Guideline.

The CCMG training guidelines are modeled after the CanMEDS framework. This framework includes the competencies required of specialists and the role of the specialist beyond that of the specialty medical expert. The other roles of the specialist are that of communicator, collaborator, manager, health advocate, scholar, and professional. The detailed objectives describe minimal standards and in no way exclude the necessity for mastery of additional knowledge, skills or attitudes necessary for the practice of molecular genetics.

Required Background
Trainees must have a PhD and/or an MD degree.

A candidate’s PhD must have a strong genetics content. The required educational experience would approximate that required for an MSc in genetics and molecular biology. If this experience is lacking, the trainee must gain this knowledge through suitable courses and/or private study.
PhD trainees must have successfully defended and submitted the final version of their PhD thesis before beginning CCMG training. The start date for training can not be before submission of the final version, with all revisions (if any) approved by the relevant university officer(s). Individuals with an MD degree must have completed at least 3 years of residency training in a program accredited by the Royal College of Physicians and Surgeons of Canada (RCPSC) and/or Collège des Médecins du Québec (CMQ).

**Administrative Aspects**

1. **Supervisory committee:**
   a. Each trainee’s program will be supervised by a committee, headed by a Fellow of the CCMG in Molecular Genetics who takes primary responsibility for the training (a.k.a. supervisor).
   b. The committee will consist of the head and a minimum of two additional members. Other members might consist of clinical geneticists and cytogeneticists. The structure of the committee will vary depending on the background of the trainee.
   c. The program director or supervisor on behalf of the committee ensures the trainee is registered with the CCMG Credentials Committee by submitting a registration form to the CCMG Secretariat by within the first three months of commencing training.
   d. The committee takes responsibility for ensuring the training program is meeting the needs of the trainee and is in keeping with CCMG guidelines, including graduation of responsibility in the laboratory and clinical setting. The committee must submit an outline of completed and planned training with the trainee’s application for credentialing.
   e. The committee meets every six months with the candidate, and ensures that in-training evaluation forms (ITER; one for each rotation and one for every 6 months for longer rotations) are completed and discussed with the trainee. If remedial work is needed by the trainee, the committee must ensure that this is provided.
   f. The committee completes and submits the Final In-Training Evaluation Report (FITER) to the CCMG secretariat prior to oral examination. Please note that the FITER is additional to the ITER covering the last 6 months of training. The committee must also submit a Completion of Training form, if the FITER does not coincide with the completion of training.

2. **Location of training**
   a. Molecular genetics training must take place in a centre accredited by the CCMG in Molecular genetics.
   b. Elective training may be done at non-accredited centres at the discretion of the supervisory committee.
   c. In the event that accreditation of a centre is terminated during the candidate’s training, the trainee will be allowed a maximum of six months to move to an accredited centre.

3. **Training in foreign centres**
   a. Training in American centres accredited by the American Board of Medical Genetics (ABMG) is recognized by the CCMG.
   b. As the ABMG and CCMG have different credentialing requirements, it is the responsibility of the trainee to ensure completion of all requirements of the CCMG.
4. Part-time training
   a. Part-time training is recognized by the CCMG, provided it conforms to all requirements in this document and the trainee spends a minimum of 50% of time in the program.
   b. The total amount of time must equal two complete years in training.

5. Second specialty training
   CCMG fellows currently certified in another laboratory specialty who want to certify in Molecular genetics must complete a minimum of 12 months full time training in a CCMG-accredited laboratory that provides molecular genetic diagnostic services. All training as outlined below in Mandatory training item 1 must be completed. The Supervisory Committee may recommend additional training depending upon previous training and experience.

6. Credentialing
   Candidates are advised to review the Credentialing requirements on the website) early in their training to facilitate Credentials submission and review.

Content of Training
Two year program, including:

Mandatory training:
1. **Minimum of 12 months in a CCMG-accredited laboratory that provides molecular diagnostic services.** Training sites must ensure compliance with their laboratory accreditation programs. This may require bench work performed by a trainee be performed using non-clinical samples or under supervision of appropriately certified individuals at the discretion of the training center and supervised result reporting (co-signed) or the use of archival cases.

   It is recognized that not all training centres will be able to provide a fully-comprehensive training program. Those responsible for training at a given center must identify any ‘gaps’ and encourage trainees to obtain the appropriate training at other CCMG- or ABMG-accredited centres to meet the overall training objectives of the program.

   Training will include:
   a. **Technical skills:** Hands-on experience in molecular diagnostic techniques, with a logbook recording involvement in **100 cases.** Cases must demonstrate experience with a variety of techniques including:
      - DNA/RNA extractions: minimum of 5 from any 3 of: blood, blood spots, buccal, tissue culture (e.g. amniocytes, CVS, fibroblast), raw amniotic fluid, CVS, saliva or tissue (e.g. muscle, thymus)
      - Sequencing: minimum 10
      - Dosage-based test: minimum 10
      - PCR fragment size analysis: minimum 10
• Technique to test for recurrent mutations (e.g. CF common mutations): minimum 10
• Specialized testing: minimum of 5 (total)
  a. Methylation-sensitive test
  b. RT-PCR-based test
  c. qf-PCR
  d. aCGH or SNP microarray testing
  e. Other

It is the responsibility of the local fellowship committee to determine if the trainee requires more cases to become familiarized with all technical aspects.

b. **Interpretative and consultative skills:** Experience in interpreting results and communicating to others, with a logbook recording involvement in 200 cases (though it is likely that more than 200 cases will be reviewed). It is the sole responsibility of the local fellowship committee to determine the total number of cases to be reviewed by the candidate to ensure a high level of competence. No more than 20 cases should have the same indication/test scenario (i.e. carrier testing for cystic fibrosis or confirmation of diagnosis for Fragile X).

**Case distribution:** The cases documented must demonstrate a variety of indications, analysis of different mutation types, and molecular genetic techniques. The representation of each indication and mutation type/technique is as follows:

**Indications:**
- Confirmation of diagnosis: minimum 20
- Prenatal: minimum 10
- Presymptomatic: minimum 20
- Carrier testing: minimum 20
- Identity testing (zygosity, maternal cell contamination, relationship testing): minimum 5

**Mutation type/technique:**
- Sequencing: minimum 10
- Dosage-based test: minimum 10
- Microsatellite-based test (identity, MCC, UPD, linkage): minimum 5
- Dynamic mutation testing: minimum 10

**Abnormal/Illustrative cases:** At least 120 of the cases must represent abnormal results (e.g. pathogenic, technical artefact, rare variant of unknown clinical significance). Illustrative scenarios may include: maternal cell contamination; handling of mislabelled specimens, chimerism. In order to meet the abnormal/illustrative minimums in each category, archival material (inactive cases illustrative of a rare abnormal that is unlikely to be seen during the training period) may be used (to a maximum of 40 archival cases). Abnormal results observed during technical experience can also be logged.

c. **Management skills:** Experience in management of a molecular diagnostic laboratory.
2. Rotations in other medical genetics specialties, including:
   a. **Cytogenetic laboratory training**: a minimum of **three months** to be spent in a CCMG-accredited laboratory providing cytogenetic diagnostic services.
   b. **Clinical genetics training**: a minimum participation in **25 patient encounters** (counseling sessions), with a CCMG/ABMG-certified clinical geneticist or CAGC/ABMG-certified genetic counselor, but not necessarily in a CCMG-accredited centre. This rotation can occur as a block or throughout the training program. The trainee should keep a logbook recording participation in a minimum of 25 counselling sessions, representing at least 4 of the following clinical scenarios: prenatal, pediatric, adult, metabolic, cancer and neurogenetic. Participation must include developing an understanding of the issues through researching the literature and discussions with clinical colleagues.

3. Courses/conferences
   a. Participation in educational events and courses prescribed by the trainee’s supervisory committee is to be documented in an education logbook.
   b. Documented attendance at one local (e.g. departmental annual research day, a research institute research day), national or international genetics meeting during the training period.

4. Research training
   a. **The trainee must participate in clinical or laboratory-based research for a period equivalent to 6 months full time research**; this may be accomplished through a dedicated 6 month block of time or distributed throughout the training period. Training may be obtained at the training centre or another hospital or university centre in Canada or abroad as approved by the candidate's supervisory committee and Program Director. The research can be applied or translational in nature such as development of a new test, test validation, test improvement, quality improvement, case follow up and cost-benefit analysis.
   b. A research supervisor must be identified and the proposed research objectives and methodology are to be submitted to the supervisory committee for review and approval. The research supervisor is responsible for completing an evaluation (ITER) of the trainee. The trainee is responsible for a written summary of completed research to be submitted to Program director and dissemination to the appropriate audience (laboratory staff, clinicians, publication).

5. Logbooks
   CCMG Logbook templates available on the CCMG website **must** be used. Patient confidentiality must be guarded. Therefore, before submitting to the CCMG, cases must have all identifiers removed so as not to be traceable. Each Logbook is in an Excel format with tabs for documentation of:
   a. Technical cases (tab: Technical Log)
   b. Consultative/interpretive cases (tab: Consultative Log)
   c. Clinical experience (tab: Clinical Log)
   d. Education experience (tab: Education Activities)
   e. Research experience (tab: Research Activities)
f. Training program (tab: Training Outline)

A logbook should not only be viewed as a mechanism for tracking the number of cases/experiences accumulated but as a means for documenting learning, illustrative cases and approaches/troubleshooting undertaken that can be reflected upon and recalled as you study for the CCMG exam and as you start your career as a laboratory geneticist. The logbook should be reviewed regularly and discussed by the supervisor and trainee to ensure they represent the breadth of testing required and acquisition of competencies.

**Elective training** provides additional training opportunities in related areas of interest to the trainee. Elective training must be approved by the supervisory committee.

1. Rotations in related fields, such as molecular pathology, biochemical genetics, embryopathology, developmental genetics, relevant aspects of obstetrics.
2. Visits to other molecular diagnostic service laboratories or CCMG training centres.
Molecular Genetics Specialty Requirements

Key and Enabling Competency Statements

Note:
The 7 Roles are the thematic groups of competencies that organize the CanMEDS format (Medical Expert, Communicator, Collaborator, Manager, Health Advocate, Scholar, Professional).

The Key Competencies are the overall culminating objectives of the training. They are meant to be summative and cumulative, while also being observable and measurable.

The Enabling Competencies are the skills that allow the Key Competencies to be achieved. The Enabling Competencies break-down the Key Competencies into observable and measurable statements.

MEDICAL EXPERT

Key Competencies

By the end of training, Molecular Genetics Trainees will demonstrate the ability to:

1. Explain advanced concepts in human molecular biology and medical genetics;
2. Define the pathobiology of human genetic disorders and their molecular genetic causes;
3. Demonstrate the ability to implement effective molecular genetic testing;
4. Relate molecular genetic testing for human inherited disease to other molecular diagnostic testing applications;
5. Demonstrate expertise with standard and advanced molecular biology techniques.

Enabling Competencies

1. Explain advanced concepts in human molecular biology and medical genetics.
   To achieve this, the Molecular Genetics Trainee will be able to:
   1.1. Discuss the general concepts of medical genetics outlined in the CCMG General Knowledge Guidelines.
   1.2. Describe general concepts of molecular biology and genetics;
       1.2.1. The structure of the human genome, genes and DNA;
       1.2.2. Mechanisms of inheritance and an understanding of nuclear and mitochondrial molecular genetics
       1.2.3. Molecular basis of gene expression, mutations in genes, effects of mutations on proteins/enzymes
1.3. Describe the resource legacy of the Human Genome project and the resources arising from the 1000 genomes project and other international genomics initiatives;
1.4. Describe the process by which alternate transcripts are produced, potential roles during development and the implications for genetic testing;
1.5. Describe the molecular basis of gene silencing including the role of chromatin, histone and DNA modifiers, transcription factors and other trans-acting factors, promoters, enhancers, locus control regions, etc. as it applies to:
   1.5.1. Imprinted regions of the genome
   1.5.2. X-inactivation
   1.5.3. Heterochromatin
1.6. Describe mechanisms of DNA repair and provide examples of disorders resulting from defects in DNA repair genes;
1.7. Describe the identification of human disease genes and susceptibility factors including the role of positional cloning, aCGH, exome and genome sequencing, and functional studies.

2. Define the pathobiology of human genetic disorders and their molecular genetic causes.
   To achieve this, the Molecular Genetics Trainee will be able to:
   2.1. Explain the pathophysiology of inherited genetic disorders, particularly those amenable to molecular diagnosis;
   2.2. Explain the nature of human variation, including mutations, polymorphism and genome variation;
   2.3. Correlate genotype and phenotype for human genetic variation;
   2.4. Use mutation databases as a tool in interpretation of human genetic variation.
   2.5. Explain how epigenetic modifications contribute to genetic disease including disorders associated with imprinting and modulation of gene expression.

3. Relate molecular genetic testing for human inherited disease to other molecular diagnostic testing applications.
   To achieve this, the Molecular Genetics Trainee will be able to:
   3.1. Describe variations detectable by molecular cytogenetic techniques and the significance of molecular cytogenetic mutations in human disease;
   3.2. Describe the difference between inherited and somatic mutations and the significance of somatic mutations in human disease;
   3.3. Demonstrate awareness of correlations between specific somatic mutations and either prognosis or response to chemotherapeutic agents in neoplastic disorders;
   3.4. Describe methods for detection of somatic mutations (loss of heterozygosity, point mutations, gene dosage abnormalities, fusion gene expression, microsatellite instability, etc);
   3.5. Explain the complementary nature of different molecular diagnostic approaches.
   3.6. Demonstrate an understanding of the advantages and disadvantages of molecular versus cytogenetic based testing in hematological, soft and solid tumor malignancies.
   3.7. Appreciate the complementary nature of other relevant diagnostic techniques (e.g. immunohistochemistry).
4. **Demonstrate expertise with standard and advanced molecular biology techniques.**  
*To achieve this, the Molecular Genetics Trainee will be able to:*

4.1. Understand the methodological basis of less commonly used molecular biology techniques including but not limited to:
   4.1.1. Propagation and manipulation of organisms used as tools in molecular analysis;
   4.1.2. Mutation scanning techniques, such as single strand confirmation polymorphisms, denaturing high performance liquid chromatography (DHPLC), protein truncation test etc;

4.2. Understand the methodological basis and demonstrate proficiency with standard molecular biology techniques including but not limited to:
   4.2.1. Reagent preparation, storage and handling
   4.2.2. Tissue culture, including sterile technique and culture of relevant cell types (i.e. amniocytes, chorionic villi, fibroblasts, lymphoblasts);
   4.2.3. DNA and RNA isolation in full scale from sources such as blood, tissue, cultured cells; in small scale, from sources such as archival materials or blood spots;
   4.2.4. Labeling techniques including isotopic and non-isotopic methods;
   4.2.5. Southern blotting or equivalent.

4.3. Understand the methodological basis and demonstrate proficiency expertise with advanced molecular biology techniques including but not limited to:
   4.3.1. Polymerase Chain Reaction including real time PCR, quantitative PCR, and other technical applications of PCR (MLPA, TaqMan assays);
   4.3.2. DNA sequencing, including basic principles and use of automation.

4.4. Understand the methodological basis and demonstrate proficiency with genomic techniques including but not limited to:
   4.4.1. Next generation sequencing and enrichment techniques for whole genome, exome and targeted resequencing (including library preparation, sequencing, data analysis).
   4.4.2. Bioinformatic tools for the interpretation of rare variants, including understanding the inherent biases of disease and control population databases.

4.5. Recognize the limitations of each molecular techniques;
4.6. Troubleshoot standard and advanced molecular techniques.
4.7. Demonstrate familiarity with array comparative genomic hybridization and SNP microarrays (including sample preparation, hybridization, data analysis and interpretation).

5. **Demonstrate the ability to implement effective molecular genetic testing.**  
*To achieve this, the Molecular Genetics Trainee will be able to:*

5.1. Describe the indications for performing molecular genetic analysis. This should be evidence-based and best practice, taking into consideration current CCMG guidelines and scientific literature;
5.2. Plan and interpret direct and indirect analysis for a variety of mutation types, including but not limited to:
   5.2.1. Recurrent point mutations (alteration of restriction sites polymorphisms, allele specific oligonucleotides, heteroduplexes, allele specific amplification, etc.);
5.2.2. Deletions and duplication (semi-quantitative PCR, quantitative PCR, multiple ligation-dependent probe amplification etc.);
5.2.3. Dynamic mutations (triplet repeat mutations, other repeat mutations etc);
5.2.4. Imprinting mutations and other epigenetic modifications;
5.2.5. Indirect molecular analyses based on linked markers.

5.3. Recognize and interpret artifacts or unusual results in molecular genetic test results and conduct appropriate investigations;
5.4. Demonstrate awareness of the variables that contribute to the quality of results and an ability to trouble shoot successfully;
5.5. Calculate genetic risk by inferential methods including linkage analysis, Bayesian probability, pedigree analysis and risk calculation in familial or potential new mutation situations;
5.6. Utilize electronic databases and resources to obtain information on genetic material and genetic variation;
5.7. Assign correct mutation nomenclature to genetic variations according to currently approved CCMG guidelines;
5.8. Classify variants in accordance with standard laboratory guidelines (e.g. ACMG classification);
5.9. Perform in silico analysis on variants of unknown clinical significance;
5.10. Recommend other genetic/non-genetic laboratory testing that would be of clinical benefit;
5.11. Use the medical/scientific literature when compiling a report;
5.12. Develop and validate a diagnostic test according to accreditation standards using standard test development procedures. This will include the appropriate interpretation of results during the course of test development, planning for subsequent experiments, and documentation of all experiments in a final report according to a standard laboratory format.

COMMUNICATOR

Key Competencies

By the end of training, Molecular Genetics Trainees will demonstrate the ability to:
1. Provide consultation for molecular diagnostic cases to health care providers, laboratory staff, patients and others;
2. Integrate clinical and laboratory information to assist with result interpretation and decision making for appropriate molecular genetic test utilization;
3. Report results and interpretation of molecular diagnostic testing to relevant individuals.

Enabling Competencies

1. Provide consultation for molecular diagnostic cases to health care providers, laboratory staff, patients and others.
   To achieve this, the Molecular Genetics Trainee will be able to:
1.1. Communicate with referring health care providers or other individuals to compile information required to assess appropriate molecular genetic investigations for clinical cases;
1.2. Convey relevant information regarding molecular genetic testing possibilities to relevant individuals.

2. **Integrate required clinical and other laboratory information for decisions regarding appropriate molecular genetic test utilization.**

   *To achieve this, the Molecular Genetics Trainee will be able to:*
   2.1. Recognize the importance of clinical or other laboratory information for cases referred for molecular diagnostic testing;
   2.2. Communicate effectively with relevant health care providers to obtain required information;
   2.3. Utilize clinical and other laboratory information to make decisions regarding appropriate molecular diagnostic testing to be performed.

3. **Report results and implications of molecular diagnostic testing to relevant individuals.**

   *To achieve this, the Molecular Genetics Trainee will be able to:*
   3.1. Correlate results with clinical or other laboratory information in reports;
   3.2. Communicate molecular diagnostic results and implications in both oral and written forms;
   3.3. Use appropriate HGVS nomenclature and include clinically relevant comments (e.g. risk calculations) in molecular genetic reports;
   3.4. Maintain patient confidentiality and privacy in the reporting of results;
   3.5. Provide consultative services regarding implications of molecular testing results and additional recommended investigations.

**COLLABORATOR**

**Key Competencies**

*By the end of training, Molecular Genetics Trainees will demonstrate the ability to:*

1. Participate effectively as a team member with relevant health care providers in collaborative decision-making for molecular diagnostic cases;
2. Mediate decision-making in inter-professional teams;
3. Contribute effectively to other interdisciplinary team activities.

**Enabling Competencies**

1. **Participate effectively as a team member with relevant health care providers in collaborative decision making for molecular diagnostic cases.**

   *To achieve this, the Molecular Genetics Trainee will be able to:*
   1.1. Describe the role and responsibilities of a clinical molecular genetics professional to other health care providers;
   1.2. Develop rapport, trust and ethical relationships with the health care team;
1. Participate effectively as a team member in activities related to molecular genetic testing, including education, research and clinical care;
1.4. Demonstrate respect for other health care professionals and their role in health care teams;
1.5. Network with other molecular diagnostic laboratories.

2. **Mediate decision-making in inter-professional teams.**
   *To achieve this, the Molecular Genetics Trainee will be able to:*
   2.1. Demonstrate appropriate conflict resolution skills;
   2.2. Facilitate communication within inter-professional teams to prevent and resolve conflicts.

3. **Contribute effectively to other interdisciplinary team activities.**
   *To achieve this, the Molecular Genetics Trainee will be able to:*
   3.1. Participate in an interdisciplinary team meeting, and demonstrate the ability to consider and respect the opinions of other team members, while contributing molecular genetic-specific expertise him/herself;
   3.2. Communicate effectively with the members of an interdisciplinary team in the resolution of conflicts, provision of feedback, and where appropriate, be able to assume a leadership role.

**MANAGER**

**Key Competencies**

*By the end of training, Molecular Genetics Trainees will demonstrate the ability to:*
1. Understand and apply the essential elements of Quality Management system within the laboratory;
2. Utilize molecular genetic testing resources effectively;
3. Manage staff, equipment and sample resources to work effectively and efficiently in a health care organization;
4. Manage time effectively and prioritize required activities.

**Enabling Competencies**

1. **Understand and apply the essential elements of a Quality Management system within the laboratory.**
   *To achieve this, the Molecular Genetics Trainee will be able to:*
   1.1. Explain the concepts of laboratory quality assurance programs, including methods of implementation and monitoring;
   1.2. Understand the principles of quality control (including, but not limited to, statistical quality control), and be able to develop an effective quality control program, to interpret quality control data and to recommend appropriate corrective action;
   1.3. Demonstrate understanding of Lab standards and guidelines such as external proficiency programs, turnaround times, etc.;
1.4. Understand the administrative, legal and physical requirements for the operation of a hospital molecular genetics laboratory including:
1.4.1. The provincial requirements for accreditation of molecular diagnostic laboratories and general hospital laboratories;
1.4.2. The Molecular Genetic requirements for CCMG-accreditation of centres.
1.5. Maintain complete and accurate records of molecular diagnostic testing.
1.5.1. Describe methods to implement and maintain an efficient system to manage laboratory information, data and reports;
1.5.2. Maintain complete records for all cases, including written, electronic and oral information;
1.5.3. Demonstrate knowledge of laboratory information systems for patient tracking and record maintenance;
1.5.4. Maintain confidentiality for all cases, including both oral and written communication;
1.5.5. Explain the medico-legal implications in the practice of molecular genetics and appropriate use of medical records.
1.6. Understand the importance of Continuous Quality Improvement (CQI) as it applies to lab policies, processes and procedures;
1.7. Describe issues in quality assurance that are unique to molecular diagnostic testing.
1.8. Demonstrate the ability to respond effectively to laboratory-related complaints.

2. Utilize molecular genetic testing resources effectively.
To achieve this, the Molecular Genetics Trainee will be able to:
2.1. Use molecular testing resources in a manner that balances costs with potential implications of results;
2.2. Organize multiple molecular diagnostic investigations in an appropriate concurrent or sequential manner.
2.3. Coordinate molecular diagnostic testing with other diagnostic investigations;
2.4. Determine what constitutes an unacceptable or suboptimal specimen or result;
2.5. Determine what constitutes the most appropriate specimen for a specific diagnostic question and how such a specimen should be procured and processed in the molecular diagnostic laboratory;
2.6. Recognize the sensitive nature of genetic samples and act to minimize potential harms;
2.7. Advise on the principles of establishing new technologies in the molecular diagnostic laboratory including but not limited to the cost/benefit ratio, sensitivity and specificity of the test and the validation of the test method and the results;
2.8. Demonstrate knowledge of the CCMG Molecular Diagnostic Practice Guidelines.

3. Manage staff and equipment to work effectively and efficiently in a health care organization.
To achieve this, the Molecular Genetics Trainee will be able to:
3.1. Describe equipment and supplies used in molecular testing and their costs;
3.2. Demonstrate the ability to prepare a laboratory budget;
3.3. Demonstrate familiarity with bids and service contracts for laboratory equipment;
3.4. Explain the technical training requirements for laboratory technologists;
3.5. Develop appropriate laboratory protocols for staff;
3.6. Demonstrate the ability to effectively prioritize the work of laboratory staff;
3.7. Describe the Workplace Hazardous Materials Information System (WHMIS) biohazard regulations and safe laboratory operating procedures;
3.8. Demonstrate understanding of the process of staff recruitment and interview skills;
3.9. Demonstrate understanding of the accreditation process and understand the process for responding to reviewers recommendations.

4. **Manage time effectively and prioritize required activities.**
   *To achieve this, the Molecular Genetics Trainee will be able to:*
   4.1. Set, prioritize and manage time to balance required activities;
   4.2. Recognize critical aspects of certain activities and allocate time appropriately.

**HEALTH ADVOCATE**

**Key Competencies**

*By the end of training, Molecular Genetics Trainees will demonstrate the ability to:*
1. Describe specific public health practices or policies that affect provision of molecular genetic testing services;
2. Respond to the health needs of individuals, communities and populations served by molecular diagnostic testing.

**Enabling Competencies**

1. **Describe specific public health practices or policies that affect provision of molecular genetic testing services.**
   *To achieve this, the Molecular Genetics Trainee will be able to:*
   1.1. Explain how health care governance influences resource allocation for molecular genetic services at the local, regional, provincial and national level;
   1.2. Describe the roles of national and international organizations in the determination of guidelines affecting molecular diagnostic testing;
   1.3. Participate in discussion regarding public policy and decision-making processes with respect to current and future molecular diagnostic testing (i.e. introduction of new tests, new platforms).

2. **Respond to the health needs of individuals, communities and populations served by molecular diagnostic testing.**
   *To achieve this, the Molecular Genetics Trainee will be able to:*
   2.1. Recognize and respond to those medical genetic issues where advocacy is appropriate;
   2.2. Become informed about community resources and related patient support groups for individuals and families served by molecular diagnostic testing;
2.3. Liaise effectively with individuals, communities and populations on issues applicable to molecular diagnostic testing;
2.4. Act as a resource and information source regarding molecular diagnostic testing for individuals, communities and populations.

SCHOLAR

Key Competencies

By the end of training, Molecular Genetics Trainees will demonstrate the ability to:
1. Conduct ongoing learning activities to maintain and advance their professional knowledge;
2. Facilitate the learning of other health care professionals, students, laboratory staff, the public and others regarding molecular diagnostic testing;
3. Conduct research projects and publish findings for advancement of knowledge.

Enabling Competencies

1. Conduct ongoing learning activities to maintain and advance their professional knowledge.
   To achieve this, the Molecular Genetics Trainee will be able to:
   1.1. Critically assess the literature as related to human genetics, molecular biology and diagnostics;
   1.2. Demonstrate commitment to continuing education events, including conferences, rounds, clinical and research seminars, and patient conferences;
   1.3. Recognize limitations of current knowledge and seek appropriate additional educational activities;
   1.4. Be aware of and maintain accreditation through ongoing CME programs (eg RCPC / CCMG MOC program).

2. Facilitate the learning of other health care professionals, students, laboratory staff, the public and others regarding molecular diagnostic testing.
   To achieve this, the Molecular Genetics Trainee will be able to:
   2.1. Demonstrate the willingness and ability to enhance and apply teaching skills in the education of colleagues, undergraduate and postgraduate trainees, and other health care professionals;
   2.2. Deliver effective lectures and presentations on human genetics and molecular biology concepts;
   2.3. Present concise and audience appropriate summaries of molecular diagnostic methodologies, clinical situations related to molecular diagnostic testing and case reports or presentations.

3. Conduct research projects and publish findings for advancement of knowledge.
   To achieve this, the Molecular Genetics Trainee will be able to:
   3.1. Plan and conduct a minimum six month research project related to human molecular genetics or molecular diagnostic testing;

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3.2. Summarize results and submit and present the results to an appropriate audience (e.g. publication in a referred journal, presentation at a conference or rounds, presentation to laboratory staff);

3.3. Identify possible personal limitations with respect to previous research experience and recognize that an additional year of research may be beneficial in certain situations for promotion and career development.

PROFESSIONAL

Key Competencies

By the end of training, Molecular Genetics Trainees will be able to:
1. Demonstrate ethical practices and a sense of responsibility in molecular diagnostic testing;
2. Demonstrate appropriate respectful behaviour consistent with a clinical molecular diagnostician.

Enabling Competencies

1. Demonstrate ethical practices and a sense of responsibility in molecular diagnostic testing.
   To achieve this, the Molecular Genetics Trainee will be able to:
   1.1. Demonstrate understanding of the regulatory framework governing the practice of medicine. These include the Legal system as well as local Medical Advisory Councils, or Appointment Boards, Provincial and Territorial licensing bodies and Federal guidelines;
   1.2. Maintain confidentiality and ensure appropriate release of molecular diagnostic samples, data and reports;
   1.3. Recognize ethical issues in molecular diagnostic testing, including but not limited to the process of consent, the needs of the patient vs. the family, the impact of cultural and personal beliefs, end of life decisions, testing of minors, impact of molecular test results on extended family members, testing for late onset disorders, prenatal testing and the use of human subjects for research;
   1.4. Identify personal limitations and the necessity of seeking the opinions of colleagues or other professionals when required;
   1.5. Identify technical laboratory limitations requiring referral to other laboratories.

2. Demonstrate appropriate respectful behavior consistent with a clinical molecular diagnostician.
   To achieve this, the Molecular Genetics Trainee will be able to:
   2.1. Demonstrate a professional attitude to clinical and laboratory colleagues, to laboratory staff, students and trainees, and patients;
   2.2. Respect the opinions of fellow consultants and referring physicians in the management of patients and be willing to accept differences of opinion;
   2.3. Demonstrate the ability to recognize and respond appropriately to abuse, gender bias, discrimination, intimidation, and disrespect;
2.4. Demonstrate the knowledge of how to sustain career satisfaction.

REFERENCE