

**2012**

**EDITORIAL REVISION – FEBRUARY 2016  
VERSION 1.1**

*This document applies to those who begin training on or after July 1<sup>st</sup>, 2012.*

*NOTE: Throughout this document, references to the patient's family are intended to include all those who are personally significant to the patient and are concerned with his or her care, including, according to the patient's circumstances, family members, partners, caregivers, legal guardians, and substitute decision-makers.*

## **DEFINITION**

Medical Biochemistry is a branch of medicine concerned with the biochemistry and metabolism in human health and disease. The Medical Biochemist is a specialist in laboratory medicine, is trained in the operation and management of clinical biochemistry laboratories, and acts as a consultant in all aspects of their use. The medical biochemist directs clinical laboratories, consults, diagnoses and treats patients with a variety of metabolic disorders and biochemical abnormalities.

## **GOALS**

Upon completion of training, a resident is expected to be a competent specialist in Medical Biochemistry capable of assuming a consultant's role in the specialty. The resident must develop comprehensive knowledge and skills in laboratory medicine related to Medical Biochemistry and be able to act as a clinical consultant in its application. Hence, the resident is expected to be competent in all aspects of organizing and running a medical biochemistry laboratory. The resident must acquire a working knowledge of the theoretical basis of the specialty, including its foundations in the basic medical sciences, research, and life-long learning.

Residents must demonstrate the knowledge, skills, and behaviours for effective patient-centred care and service to a diverse adult and pediatric population. In all aspects of specialist practice, the graduate must be able to address issues of gender, sexual orientation, age, culture, beliefs, and ethnicity in a professional manner in each of the domains of clinical consultation, advocacy, management, administration, research protocols, data presentation, and analysis. Emphasis is placed on effective collaboration with laboratory technologists, physicians, other health care providers, and communication with patients and the community.

## MEDICAL BIOCHEMISTRY COMPETENCIES

At the completion of training, the resident will have acquired the following competencies and will function effectively as a:

### Medical Expert

#### **Definition:**

As *Medical Experts*, Medical Biochemists integrate all of the CanMEDS Roles, applying medical knowledge, laboratory skills, clinical skills, and professional attitudes in their provision of patient-centred care. *Medical Expert* is the central physician Role in the CanMEDS framework.

#### **Key and Enabling Competencies: Medical Biochemists are able to...**

### **1. Function effectively as consultants, integrating all of the CanMEDS Roles to provide optimal, ethical and patient-centred medical care**

- 1.1. Perform a consultation, including the presentation of well-documented assessments and recommendations in oral, written, and/or electronic form in response to a request from another health care professional
- 1.2. Demonstrate use of all CanMEDS competencies relevant to Medical Biochemistry
- 1.3. Identify and appropriately respond to relevant ethical issues arising in patient care, research or laboratory functions
- 1.4. Demonstrate the ability to prioritize professional duties when faced with multiple patients, multiple laboratory tasks, and problems related to these
- 1.5. Demonstrate compassionate and patient-centred care
- 1.6. Recognize and respond to the ethical dimensions in medical decision-making
- 1.7. Demonstrate medical expertise in situations other than patient care, such as providing expert legal testimony or advising governments, as needed

### **2. Establish and maintain clinical knowledge, skills and behaviours appropriate to Medical Biochemistry**

- 2.1. Apply knowledge of the clinical, socio-behavioural, and fundamental biomedical sciences relevant to Medical Biochemistry
  - 2.1.1. Demonstrate the expertise needed to direct clinical investigations of common disorders in:
    - 2.1.1.1. Normal and abnormal biochemistry and metabolism
    - 2.1.1.2. Nutrition
    - 2.1.1.3. Endocrinology
    - 2.1.1.4. Diseases of bone metabolism and nephrolithiasis
    - 2.1.1.5. Pharmacology

## OBJECTIVES OF TRAINING IN MEDICAL BIOCHEMISTRY (2012)

- 2.1.1.6. Toxicology
  - 2.1.1.7. Immunology
  - 2.1.1.8. Genetics, including inborn errors of metabolism
  
  - 2.1.2. Demonstrate clinical competence in the diagnosis and clinical management of patients with conditions characterized by the need for clinical biochemistry assessment and/or monitoring, which may include but is not limited to diabetes mellitus, cardiovascular disease prevention and nutritional deficiency or excess
  
  - 2.1.3. Demonstrate expertise in the principles and limitations of general and special analyses currently used in clinical biochemistry laboratories. Demonstrate expertise necessary to adequately supervise the technical performance, interpretation and reporting of results. Residents must be able to adequately supervise the technical performance of the analysis, and to accurately interpret and report the analytical results in the following:
    - 2.1.3.1. General clinical chemistry
    - 2.1.3.2. Spectrophotometry
    - 2.1.3.3. Enzymology
    - 2.1.3.4. Immunochemistry
    - 2.1.3.5. Electrochemistry
    - 2.1.3.6. Electrophoretic methods
    - 2.1.3.7. Urine and body fluids microscopy
    - 2.1.3.8. Isotopes
    - 2.1.3.9. Point of care testing
    - 2.1.3.10. Chromatography
    - 2.1.3.11. Mass spectrometry
    - 2.1.3.12. Molecular or genetic testing
  
  - 2.1.4. Demonstrate the ability to apply principles of epidemiology and statistics that are relevant to the practice of medical biochemistry
  
  - 2.1.5. Describe the operating principles of manual and automated analytical instruments, including the limitations of their use
  
  - 2.1.6. Demonstrate the ability to establish the precision, accuracy, and linear range of instrument methods
  
  - 2.1.7. Describe the evidence for the clinical performance and utility of assays used in medical biochemistry and provide proper interpretation of results for medical and surgical patients in adult, pediatric, and women's health environments
  
  - 2.1.8. Demonstrate ability to supervise pre-analytical, analytical and post-analytical aspects of laboratory procedures relevant to medical biochemistry
  
  - 2.1.9. Demonstrate the ability to establish proper reference ranges
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- 2.2. Describe the CanMEDS framework of competencies relevant to Medical Biochemistry
- 2.3. Apply lifelong learning skills of the Scholar Role to implement a personal program to keep up-to-date, and enhance areas of professional competence
- 2.4. Integrate the available best evidence and best practices to enhance the quality of care and patient safety in their practice

**3. Perform a complete and appropriate assessment of a patient**

- 3.1. Identify and explore issues to be addressed in a patient encounter, including the patient's cultural context and goals of therapy
- 3.2. Elicit a history that is relevant, clear, concise, and accurate with regards to cultural context and patient values and preferences, for the purposes of diagnosis, management, therapy, health promotion, and disease prevention
- 3.3. Perform a focused physical examination that is relevant and accurate, for the purposes of diagnosis, management, health promotion, and disease prevention
- 3.4. Select medically appropriate investigative methods in a resource-effective and ethical manner
- 3.5. Integrate medical history and physical findings with the laboratory investigation and plan further investigations to aid in differential diagnosis and management

**4. Use preventive and therapeutic interventions effectively**

- 4.1. Implement a management plan in collaboration with other clinicians, patients and/or their families
- 4.2. Demonstrate appropriate and timely application of preventative laboratory security procedures relevant to Medical Biochemistry
- 4.3. Ensure appropriate informed consent is obtained for therapies

**5. Demonstrate proficient and appropriate use of procedural skills, both diagnostic and therapeutic**

- 5.1. Demonstrate effective, appropriate, and timely performance of diagnostic procedures relevant to Medical Biochemistry
  - 5.1.1. Perform accurate basic microscopic analysis of body fluids, including but not limited to urine and synovial fluid
- 5.2. Ensure appropriate informed consent is obtained for procedures
- 5.3. Document and disseminate information related to procedures performed and their outcomes
- 5.4. Ensure adequate followup is arranged for procedures performed

**6. Seek appropriate consultation from other health professionals, recognizing the limits of their own expertise**

- 6.1. Demonstrate insight into their own limits of expertise
- 6.2. Demonstrate effective, appropriate, and timely consultation of another health professional, as needed for optimal patient care
- 6.3. Arrange appropriate followup care services for patients and their families/caregivers

**Communicator**

***Definition:***

As *Communicators*, Medical Biochemists effectively facilitate the doctor-patient relationship and the dynamic exchanges that occur before, during, and after the medical encounter.

***Key and Enabling Competencies: Medical Biochemists are able to...***

**1. Develop rapport, trust, and ethical therapeutic relationships with patients and families**

- 1.1. Recognize that being a good communicator is a core clinical skill for physicians, and that effective physician-patient communication can foster patient satisfaction, physician satisfaction, adherence, and improved clinical outcomes
- 1.2. Establish positive therapeutic relationships with patients and their families that are characterized by understanding, trust, respect, honesty, and empathy
- 1.3. Respect patient privacy, confidentiality, and autonomy
- 1.4. Listen effectively
- 1.5. Be aware of and responsive to nonverbal cues
- 1.6. Facilitate a structured clinical encounter effectively

**2. Accurately elicit and synthesize relevant information and perspectives of patients and families, colleagues, and other professionals**

- 2.1. Gather information about a disease and about a patient's beliefs, concerns, expectations, and illness experience
- 2.2. Seek out and synthesize relevant information from other sources, such as a patient's family, caregivers, and other professionals, while respecting individual privacy and confidentiality

**3. Convey relevant information and explanations accurately to patients and families, colleagues, and other professionals**

- 3.1. Deliver information to a patient and family, colleagues, and other professionals in a humane manner and in such a way that it is understandable and encourages discussion and participation in decision-making

**4. Develop a common understanding on issues, problems and plans with patients, families, and other professionals to develop a shared plan of care**

- 4.1. Identify and effectively explore problems to be addressed from a patient encounter, including the patient's context, responses, concerns, and preferences
- 4.2. Respect diversity and difference, including but not limited to the impact of gender, religion, and cultural beliefs on decision-making
- 4.3. Encourage discussion, questions, and interaction in the encounter
- 4.4. Engage patients, families, and relevant health professionals in shared decision-making to develop a plan of care
- 4.5. Address challenging communication issues effectively, including but not limited to obtaining informed consent, delivering bad news, and addressing anger, confusion, and misunderstanding

**5. Convey oral, written, and electronic information effectively about a medical encounter**

- 5.1. Maintain clear, concise, accurate, and appropriate records of clinical encounters and plans
  - 5.1.1. Recognize the importance of maintenance of laboratory documentation
  - 5.1.2. Identify the legal requirements for maintenance of laboratory patient reports, documentation of laboratory procedures laboratory participation in quality control and quality assurance programs for each test procedure
- 5.2. Present oral clinical and laboratory reports of clinical encounters and plans
  - 5.2.1. Produce accurate individual reports for laboratory procedures requiring interpretation including, but not limited to protein electrophoresis, immunofixation, high performance liquid chromatography (HPLC) testing, polymerase chain reaction (PCR) and other molecular diagnostic procedures
  - 5.2.2. Incorporate diagnostics and management plans into a formal Medical Biochemistry consultation report

**6. Present medical information effectively to the public or media about a medical issue**

## **Collaborator**

### ***Definition:***

As *Collaborators*, Medical Biochemists effectively work within a health care team to achieve optimal patient care.

### ***Key and Enabling Competencies: Medical Biochemists are able to...***

#### **1. Participate effectively and appropriately in an interprofessional health care team**

- 1.1. Describe the Medical Biochemist's roles and responsibilities to other professionals
- 1.2. Describe the roles and responsibilities of other professionals within the health care team, relevant to Medical Biochemistry
- 1.3. Recognize and respect the diverse roles, responsibilities and competencies of other professionals in relation to their own
- 1.4. Work with others to assess, plan, provide, and integrate care for individuals and groups of patients
- 1.5. Work with others to plan and provide quality laboratory services
- 1.6. Work collaboratively in other activities and tasks; examples are research, educational work, program review, and/or administrative responsibilities
- 1.7. Participate in interprofessional team meetings
- 1.8. Enter into interdependent relationships with other professions for the provision of quality care
- 1.9. Describe the principles of team dynamics
- 1.10. Respect team ethics, including confidentiality, resource allocation, and professionalism
- 1.11. Demonstrate leadership in a health care team, as appropriate
- 1.12. Provide support to laboratory technologists and other laboratory personnel, listen to their needs, and help them develop and maintain their competencies

#### **2. Work with other health professionals effectively to prevent, negotiate, and resolve interprofessional conflict**

- 2.1. Demonstrate a respectful attitude towards other colleagues and members of an interprofessional team
- 2.2. Work with other professionals to prevent conflicts
- 2.3. Respect differences and the scopes of practice of other professions
- 2.4. Recognize their own differences, misunderstandings, and limitations that may contribute to interprofessional tension
- 2.5. Reflect on interprofessional team function, both in the clinic and the laboratory

- 2.6. Employ collaborative negotiation to resolve conflicts and address misunderstandings

## Manager

### **Definition:**

As *Managers*, Medical Biochemists are integral participants in health care organizations, organizing sustainable practices, making decisions about allocating resources, and contributing to the effectiveness of the health care system.

### **Key and Enabling Competencies: Medical Biochemists are able to...**

#### **1. Participate in activities that contribute to the effectiveness of their health care organizations and systems**

- 1.1. Work collaboratively with others in their organizations
- 1.2. Participate in systemic quality process evaluation and improvement, including patient safety initiatives, and apply the principles of total quality management from test ordering to health care professionals' interpretation of results
  - 1.2.1. Establish policies and procedures for specimen collection, result reporting, quality assurance and laboratory safety
  - 1.2.2. Demonstrate laboratory safety procedures relevant to Medical Biochemistry
    - 1.2.2.1. Radiation safety
    - 1.2.2.2. Chemical safety with regard to caustic chemical reagents, including acids, bases, and mercury
    - 1.2.2.3. Laboratory application of WHMIS (Workplace Hazardous Materials Information System) or SIMDUT (Système d'information sur les matières dangereuses utilisées au travail)
    - 1.2.2.4. Biologic safety with regard to handling of potentially infective body fluids
  - 1.2.3. Demonstrate the ability to develop an effective quality assurance program, to interpret quality assurance data and to recommend appropriate corrective action
  - 1.2.4. Maintain a quality assurance program and contribute to the enhancement of quality care and patient safety in medical biochemistry, integrating regulations, the available best evidence and best practices
  - 1.2.5. Apply standardized procedures in the laboratory and comply with local legal and accreditation requirements including the medical biology laboratory quality and competence norm ISO15189 (International Organization for Standardization)



## OBJECTIVES OF TRAINING IN MEDICAL BIOCHEMISTRY (2012)

- 1.3. Describe the structure and function of the health care system as it relates to Medical Biochemistry, including the roles of physicians
  - 1.3.1. Describe the functional organization of a clinical biochemistry laboratory
- 1.4. Describe principles of health care financing, including physician remuneration, budgeting, and organizational funding
  - 1.4.1. Describe the components of a laboratory budget and their relative importance
  - 1.4.2. Describe the work load units for laboratory tests
  - 1.4.3. Determine the cost of a laboratory procedure
  - 1.4.4. Explain the process of selection and acquisition of new instrumentation
- 1.5. Demonstrate the ability to direct the day-to-day operations of a clinical biochemical laboratory

### **2. Manage their practice and career effectively**

- 2.1. Set priorities and manage time to balance laboratory duties, patient care, practice requirements, outside activities, and personal life
- 2.2. Manage a practice, including finances and human resources
  - 2.2.1. Describe the administrative, legal, and physical requirements for the operation of a clinical biochemistry laboratory
  - 2.2.2. Describe the mechanisms of Medical Biochemists' remuneration
- 2.3. Implement processes to ensure personal practice improvement
- 2.4. Employ information technology appropriately for patient care
  - 2.4.1. Apply appropriate information technologies to access and analyze data to solve individual patient problems
  - 2.4.2. Demonstrate an understanding of laboratory information systems
  - 2.4.3. Apply appropriate information technologies for sharing of data, quality assurance, utilization review and management relevant to medical biochemistry

### **3. Allocate finite health care resources appropriately**

- 3.1. Demonstrate an understanding of the importance of just allocation of health care resources, balancing effectiveness, efficiency, and access with optimal patient care
- 3.2. Apply evidence and management processes for cost-appropriate care

**4. Serve in administration and leadership roles, as appropriate**

- 4.1. Chair or participate effectively in committees and meetings
- 4.2. Lead or implement change in health care
- 4.3. Plan relevant elements of health care delivery
- 4.4. Demonstrate leadership abilities for the management of a clinical laboratory

**Health Advocate**

***Definition:***

As *Health Advocates*, Medical Biochemists responsibly use their expertise and influence to advance the health and well-being of individual patients, communities, and populations.

***Key and Enabling Competencies: Medical Biochemists are able to...***

**1. Respond to individual patient health needs and issues as part of patient care**

- 1.1. Identify the health needs of an individual patient
- 1.2. Identify opportunities for advocacy, health promotion, and disease prevention with individuals to whom they provide care
- 1.3. Promote the use of appropriate testing
- 1.4. Provide effective reporting and followup for laboratory results suggesting imminent danger for the patient and prompting immediate clinical intervention (critical values)

**2. Respond to the health needs of the communities that they serve**

- 2.1. Describe the practice communities that they serve
- 2.2. Identify opportunities for advocacy, health promotion, and disease prevention in the communities that they serve, and respond appropriately
  - 2.2.1. Identify opportunities to improve health care accessibility and delivery of cost effective laboratory services in urban and non-urban communities
  - 2.2.2. Describe the principles and use of laboratory testing for mass screening, including but not limited to newborn screening for metabolic disease, pregnancy screening, and cancer screening
- 2.3. Demonstrate an appreciation of the possibility of competing interests between the communities served and other populations

**3. Identify the determinants of health for the populations that they serve**

- 3.1. Identify the determinants of health of the population, including barriers to access to care and resources

- 3.2. Identify vulnerable or marginalized populations within those served and respond appropriately

**4. Promote the health of individual patients, communities, and populations**

- 4.1. Describe an approach to implementing a change in a determinant of health of the populations they serve
- 4.2. Describe how public policy impacts on the health of the populations served
- 4.3. Identify points of influence in the health care system and its structure
- 4.4. Describe the ethical and professional issues inherent in health advocacy, including altruism, social justice, autonomy, integrity, and idealism
- 4.5. Demonstrate an appreciation of the possibility of conflict inherent in their role as a health advocate for a patient or community with that of manager or gatekeeper
- 4.6. Describe the role of the medical profession in advocating collectively for health and patient safety

**Scholar**

***Definition:***

As *Scholars*, Medical Biochemists demonstrate a lifelong commitment to reflective learning, as well as the creation, dissemination, application and translation of medical knowledge.

***Key and Enabling Competencies: Medical Biochemists are able to...***

**1. Maintain and enhance professional activities through ongoing learning**

- 1.1. Describe the principles of maintenance of competence
- 1.2. Describe the principles and strategies for implementing a personal knowledge management system
- 1.3. Recognize and reflect on learning issues in practice
- 1.4. Conduct a personal practice audit
- 1.5. Pose an appropriate learning question
- 1.6. Access and interpret the relevant evidence
- 1.7. Integrate new learning into practice
- 1.8. Evaluate the impact of any change in practice
- 1.9. Document the learning process

**2. Critically evaluate medical information and its sources, and apply this appropriately to practice decisions**

- 2.1. Describe the principles of critical appraisal
  - 2.1.1. Identify criteria that determine the quality of clinical trials
  - 2.1.2. Identify criteria used to evaluate the quality of diagnostic tests and laboratory methods
- 2.2. Critically appraise retrieved evidence in order to address a clinical or laboratory question
- 2.3. Integrate critical appraisal conclusions into clinical care and laboratory practices

**3. Facilitate the learning of patients, families, students, residents, other health professionals, the public and others, as appropriate**

- 3.1. Describe principles of learning relevant to medical education
- 3.2. Identify collaboratively the learning needs and desired learning outcomes of others
- 3.3. Select effective teaching strategies and content to facilitate others' learning
- 3.4. Demonstrate effective lectures or presentations
- 3.5. Assess and reflect on teaching encounters
- 3.6. Provide effective feedback
- 3.7. Describe the principles of ethics with respect to teaching

**4. Contribute to the development, dissemination, and translation of new knowledge and practices**

- 4.1. Describe the principles of research and scholarly inquiry
- 4.2. Describe the principles of clinical research ethics
- 4.3. Demonstrate the ability to complete a scholarly project by performing the following essential tasks:
  - 4.3.1. Pose a relevant scholarly question related to the practice of Medical Biochemistry including but not limited to: basic or clinical research, method development, clinical and/or laboratory audit, educational or ethical issues in laboratory medicine/research, or laboratory quality management
  - 4.3.2. Demonstrate knowledge of research costing in Medical Biochemistry
  - 4.3.3. Complete a research ethics proposal as required
  - 4.3.4. Interpret and synthesize the results of the study performed
  - 4.3.5. Disseminate the results of the study in an acceptable format
  - 4.3.6. Develop a plan for the application of the new knowledge to medical or laboratory practice if appropriate

## **Professional**

### ***Definition:***

As *Professionals*, Medical Biochemists are committed to the health and well-being of individuals and society through ethical practice, profession-led regulation, and high personal standards of behaviour.

### ***Key and Enabling Competencies: Medical Biochemists are able to...***

#### **1. Demonstrate a commitment to their patients, profession, and society through ethical practice**

- 1.1. Exhibit appropriate professional behaviors in practice, including honesty, integrity, commitment, compassion, respect, and altruism
- 1.2. Demonstrate a commitment to delivering the highest quality care and maintenance of competence
- 1.3. Recognize and appropriately respond to ethical issues encountered in practice
- 1.4. Identify, declare, and manage perceived, potential, and actual conflicts of interest
- 1.5. Recognize the principles and limits of patient privacy and confidentiality, as defined by the law and professional practice standards
  - 1.5.1. Explain issues of confidentiality for laboratory reports sent through laboratory information systems and by e-mail, fax, or phone
  - 1.5.2. Comply with provincial and federal privacy legislation, and laboratory error reporting
- 1.6. Maintain appropriate boundaries with patients

#### **2. Demonstrate a commitment to their patients, profession, and society through participation in profession-led regulation**

- 2.1. Demonstrate knowledge and understanding of professional, legal, and ethical codes of practice
- 2.2. Fulfill the regulatory and legal obligations required of current practice
- 2.3. Demonstrate accountability to professional regulatory bodies
- 2.4. Recognize and respond appropriately to others' unprofessional behaviours in practice
- 2.5. Participate in peer review

**3. Demonstrate a commitment to physician health and sustainable practice**

- 3.1. Balance personal and professional priorities to ensure personal health and a sustainable practice
- 3.2. Strive to heighten personal and professional awareness and insight
- 3.3. Recognize other professionals in need and respond appropriately

**APPROVED** – Specialty Standards Review Committee – April 2012

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