National Occupational Standard for

Research Scientist in Bio-Health

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Igniting the bio-economy's brainpower

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2 A COMPETENCY FRAMEWORK FOR INDIVIDUALS WORKING IN THE BIO-ECONOMY

2.1 What is a National Occupational Standard?

In Canada, National Occupational Standards are industry-developed and validated documents that identify and group tasks/competencies associated with a particular occupation. They also describe the knowledge and skills that a worker must demonstrate to be considered competent.

The former Alliance of Sector Councils (TASC) outlined 11 guiding principles for creating National Occupational Standards (NOS). NOS for the Canadian bio-economy meet all 11 principles and are developed to meet the current and future human capital management needs of the Canadian bio-economy.

2.2 How are we defining a competency?

We define a competency as ***a set of related behaviors that describe successful performance in a designated area. It is a behavioural expression of how people integrate knowledge, skills, attributes, and attitudes to produce a value-adding result in a defined situation.***

The competency statement includes a description that integrates skills, knowledge, and actions into a sequence of activities that deliver a value-added product or service.

Performance Indicators is the term we use for the behaviours grouped under each competency that describe the level of mastery the incumbent role must demonstrate when executing a task.

For this project, we have organized the competencies into four categories.

Core Competencies are those competencies that describe the "essence of the role" — that is, they are the one to three most critical competencies that may be applicable across multiple roles in a function or job family. All levels of personnel in this function would typically share them. These competencies may also act as qualifiers that differentiate the function from other functions.

Technical Competencies are those competencies related to specific roles or professions that enable an individual to work, function, and succeed in that role. They address the various responsibilities that job incumbents encounter in a role. For example, a surgeon's technical competencies would encompass multiple surgical tools, techniques, and conditions that could be part of the position. Similarly, technical competencies for a lawyer would contain various legal situations that they encounter in the context of a particular field of practice.

Regulatory Competencies are those competencies that describe compliance with prescribed practices and mandated obligations under applicable laws, regulations, and industry standards. They ensure that critical work processes are implemented and integrated into all work activities. They are of absolute importance where economic behaviours can impact human conditions.

Personal/professional Competencies are those competencies that enable an individual to be successful working with others and fulfilling their responsibilities in a work context. Personal and professional competencies are not necessarily role specific.

2.3 Levels of complexity of work

It is important to recognize how the complexity of work varies along an organizational continuum. At one end of this continuum is low-complexity, clearly-defined, task-driven work. At the other end of the continuum is work that is higher in complexity, not as well-defined, and requires higher-level thinking and decision-making skills and a greater degree of autonomy. Results are recognised over a longer period of time and are more difficult to assess.

Figure 1: Demonstrates how the level of complexity changes with the role responsibilities

Complexity Level	Examples of Work at Different Complexity Levels	Typical Roles/Titles
Most Complex	Construct and pursue worldwide strategic plans in large corporations.	CEOs of the largest trans-global corporations
	Construct and pursue worldwide strategic plans.	C-suite executives at multi-national organizations
	Lead the accumulated impact of multiple business units.	C-suite executive at large, multi-location organizations
	Optimize the function of a single business unit or corporate support staff.	General manager; plant manager
	Manage multiple, interdependent projects; balance resources among departments.	Engineering manager
	Plan and carry out sequential projects while considering contingencies and alternatives.	Maintenance manager
	Accumulate information to diagnose and anticipate problems; proactive; notice trends.	Maintenance technician
Least Complex	Follow predefined procedures; seek help when encountering an obstacle. The ability to anticipate problems is not expected.	Maintenance labourer

We define the complexity levels within the profiles at four levels:

Foundational — performance focus is on the execution of procedures and tasks involving own job role.

Operational — performance focus includes some discretion in the planning and executing of work. The work typically includes assessing the quality of the work outcomes and taking corrective action to ensure quality.

Specialist — performance focus is on translating goals and standards to team members and ensuring that work done under the person's responsibility area complies with all corporate standards.

Strategic — performance focus is on leading work and the accumulated impact of work in an independent business unit or across a whole organization. The impact of work at this level is often not visible until the medium to longer term.

The following example illustrates the different complexity levels within a profile.

Competency Name: Research Ethics **Competency Definition:** Exercises integrity and professionalism to ensure all research is performed responsibly in keeping with the ethical principles of beneficence and nonmaleficence. Competence at this level is demonstrated when the **Research Manager**:			
Performance Indicators			
Foundational	Operational	Specialized	Strategic
Diligently follows research procedures and protocols mandated by legitimate authorities and professional organizations.	Regularly monitors own actions and decisions to ensure they align with professional and organizational values.	Holds self and staff accountable to the organization's values, ensuring compliance with the policies and procedures related to scientific ethics and rules of conduct.	Fosters an organizational culture of integrity and ethical business practices by unwavering personal example.

2.4 Overview methodology for the development of national occupational standards

National occupational standards were developed using a multi-step process.

Step	Description	Result/Output
1	Identify critical roles in the bio-economy through primary and secondary research.	List of 50 key roles
2	Create draft profiles with critical competencies for the roles, performance, and knowledge indicators.	Draft profiles
3	Review the draft profiles with industry subject matter experts to refine the competencies, performance, and knowledge indicators.	Reviewed profile with design inputs from industry experts
4	Further validation and review by industry via online focus group.	Validated profiles by industry experts
5	Broader validation of the draft profiles via national online surveys.	Occupational Standards validated on a national level by experts from the different sectors
6	Addition of the Essential Skills and Canadian Language Benchmark (ES/CLB) ratings.	Nationally validated NOS profiles with ES/CLB profile for each NOS

3 RESEARCH SCIENTIST IN BIO-HEALTH COMPETENCY FRAMEWORK

3.1 Competency diagram Research Scientist in Bio-Health

Competencies		Complexity Level			
		1	2	3	4
Core Competency					
1	Research Ethics			■	
Technical Competencies					
2	Developing &/or Overseeing an R&D Program		■		
3	Designing an R&D Project			■	
4	Planning & Implementing R&D Projects			■	
5	Recruiting &/or Managing the R&D Team			■	
6	Data Generation & Analysis				■
7	Applying Model Laboratory Practices			■	
8	Managing Quality in R&D			■	
9	Professional Writing for R&D			■	
10	Digital Skills for R&D			■	
11	Knowledge Transfer		■		
Industry Regulatory Competencies					
12	Legal/Regulatory Compliance in R&D			■	
Personal and Professional Competencies					
13	Collaboration			■	
14	Continuous Learning			■	
15	Critical Thinking/Decision-Making in R&D			■	
16	Effective Interpersonal Communication			■	
17	Professionalism/Emotional & Cultural Intelligence			■	

Complexity Level Legend

1. Foundational
2. Operational
3. Specialist/Manager
4. Expert/Executive

3.2 Definition of occupation

The Research Scientist plans, conducts, and analyzes research, undertakes experiments and other tests, and analyzes the results. The purpose may be development of new products, processes and/or applications, or improvement of existing practices or products through innovation or further research and development (R&D). Research may be foundational, such as investigating the underlying basis of health and disease, or it may be more applied, such as developing medical devices, conducting genetic research, conducting clinical research in support of clinical trials, investigating methods of prevention, diagnosis, and treatment of human disorders. Knowledge transfer/translation and communication of results may be required as well.

The Research Scientist is also responsible for formulating budgets and overseeing projects in the laboratory. In addition, the Research Scientist may apply for grants from funding agencies and publish research articles in peer reviewed journals.

The role works in the following subsector:

Applicable To	Bio-Health	Agri-Bio	Bio-Industrial	Bio-Energy

The level of complexity of the role is:

Span of Complexity Levels	Foundational	Operational	Specialist/ Management	Expert/Executive

3.3 Level of education, training, or designations requirements

Typical Education Required	Secondary	College	Bachelor	Master	PhD
Typical Starting Experience	0–5 yrs.	5–10 yrs.	10–15 yrs.	15–20 yrs.	20+ yrs.

- PhD in a scientific discipline is recommended, or a MSc with equivalent relevant experience
- Postdoctoral or industrial experience may be an asset in some positions
- Technical experience in methods specific to the type of research activity is recommended
- Experience in experiment planning, data analysis, and reporting results is essential
- Experience in training others on scientific techniques and managing students/research technicians is essential

3.4 Core competencies list for Research Scientist in Bio-Health

3.4.1 Research Ethics

Exercises integrity and professionalism to ensure all R&D is performed in a responsible manner in keeping with the ethical principles of beneficence and nonmaleficence.

Competency in this role is demonstrated when the Individual:

- Models integrity and respect in all related actions and decisions, ensuring own actions and decisions follow the letter and spirit of the professional code of conduct for R&D.
- Ensures staff are sufficiently trained in policies/procedures related to ethics and conduct.
- Holds self and staff accountable to the organization's values, ensuring compliance with the policies and procedures related to scientific ethics and rules of conduct.
- Includes all study demographics and data necessary to present a complete and accurate picture of study results.

- Ensures that the required ethics approval certificate is secured from the Research Ethics Board (REB) before undertaking a research project.
- Ensures that the use of public funds and resources meet the policies of good stewardship.
- Ensures best statistical practices are applied to data analysis to produce the most accurate outcomes.
- Applies scientific principles to ensure that experiments minimize risk to self, laboratory workers, the environment, and/or the broader public.
- Respects intellectual property rights and the principles of the Nagoya Protocols on Biodiversity.

Knowledge required for competency at this level:

- TCPS2 certification from the federal government, if applicable
- Working knowledge of the organization's code of conduct
- Working knowledge of relevant scientific ethical issues, e.g., working with human tissues, use of animals in research, and use and storage of data, etc.
- Working knowledge of the implications of the General Data Protection Regulation (GDPR) for Canadian businesses

3.5 Technical competencies list for Research Scientist in Bio-Health

3.5.1 Developing &/or Overseeing an R&D Program

Defines the focus and strategy of the laboratory/organization's R&D program, determines which projects will be included in the program, generates funding to support the program, and oversees the program from inception to commercial development, if applicable.

Competency in this role is demonstrated when the individual:

- Conducts systematic literature reviews to identify potential areas of focus for the organization's R&D program, considering the value of this area of focus to society and to the organization.
- Contributes scientifically viable ideas and suggestions to stimulate discussion in the development of the organization's strategic R&D plan.
- Works within an interdisciplinary team, including stakeholders, to help develop and define the R&D program, assisting in testing hypotheses and developing funding proposals.

- Participates in the evaluation of the R&D program.

Knowledge required for competency at this level:

- Working understanding of how to effectively review scientific literature and evaluate different areas of focus
- Basic understanding of the process for translating R&D to commercial products
- Basic understanding of interdisciplinary sciences

3.5.2 Designing an R&D Project

Defines the parameters and specifications of a research/development project, including the project scope, objective, goals, resource requirements, project timeline, and budget. Also designs the experiments and identifies the testing and validation methodologies that can be employed to create a manageable research/development project.

Competency in this role is demonstrated when the Individual:

- Defines the project scope, including the inquiries to be addressed by the project, the major objectives, critical success factors for performance measurement and project evaluation, deliverables, assumptions, and constraints.
- Determines go/no-go decisions, key milestones and high-level budgets, timelines, and resource requirements.
- Ensures that the project design incorporates the ethical parameters required to secure a certificate of ethical approval from the REB or other equivalent approval body.
- Generates the overall experimental strategy and hypotheses for the research/development project.
- Ensures the experimental strategy is of optimum quality to deliver meaningful research/development results.
- Identifies the potential testing and validation methodologies that are compliant with regulatory requirements for this type of project.
- Writes proposals to secure project funding from internal or external sources, including application for tax incentive programs.
- Verifies that all governance procedures and regulatory requirements are defined and communicated to stakeholders.
- Prepares a project initiation document to facilitate a smooth hand-off from project design to project planning and implementation.

Knowledge required for competency at this level:

- Working knowledge of project management principles and techniques
- Working understanding of the project stages and the transition management process at the end of each stage
- In-depth knowledge of the regulatory requirements related to the project
- In-depth knowledge of preclinical pharmacokinetic and pharmacodynamic (PK & PD) studies if appropriate
- In-depth knowledge of the project context and requirements and other standards
- In-depth knowledge of the statistical design of research experiments
- In-depth knowledge of relevant literature and technical tools available to the field of R&D
- In-depth understanding of the company's strategic direction, roadmaps, and milestones
- Working understanding of the design and manufacturing processes

3.5.3 Planning & Implementing R&D Projects

Prepares a deliverable-oriented work breakdown structure that details milestones, resources, schedules, and budget for the planned project outcomes. Also develops a risk-management plan, manages activities, provides project updates, and oversees project close-out to ensure project outcomes are delivered on time and in budget.

Competency in this role is demonstrated when the individual:

- Collaborates with stakeholders to clearly articulate project deliverables, create a shared understanding of the full scope of the project (what is and is not included), and establish communication frequency and methods.
- Breaks the deliverables down into major milestones with input from subject matter experts in each work stream.
- Establishes a milestone schedule, identifying the planned start and finish dates of each milestone.
- Determines staffing and physical resource requirements for each milestone, scheduling them as required.
- Identifies risks that may be encountered throughout the project and develops a risk elimination or mitigation strategy for each one.
- Designs and implements quality control criteria for the project.
- Develops a detailed project budget, identifying when funds will be required throughout the project.
- Manages the project schedule, budget, and any associated contracts to ensure the project is delivered within the defined scope, budget, and schedule.

- Provides regular project updates to management and other stakeholders.
- Closes out the project by confirming completion of deliverables and payments, preparing a final report on budget, methodology, results, and recommendations, and transferring all files to the project file storage system.

Knowledge required for competency at this level:

- Detailed knowledge of a project management system and tools, such as Primavera, Microsoft Project, Microsoft Excel, etc.
- Working understanding of the project management process—including project stages and the transition management process at the end of each stage—as would be gained in PMP, CPM, or PRINCE2 programs
- In-depth knowledge of the regulatory requirements related to the project
- Comprehensive knowledge of schedule management techniques such as critical path management, Program Evaluation & Review Technique (PERT) analysis, GANTT charts, and decision trees

3.5.4 Recruiting &/or Managing the R&D Team

Recruits and manages a qualified workforce to ensure the organization's R&D program and projects are properly staffed and that the team is managed in a way that fosters not only compliance to requirements and protocols, but also high performance, strong morale, and a high retention rate.

Competency in this role is demonstrated when the individual:

- Ensures all relevant employment standards are adhered to in the recruitment, hiring, and management of team members with support from HR.
- Provides an effective orientation and onboarding process to ensure new team members get off to a good start.
- Aligns team goals with project and organizational goals to ensure the team achieves the project goals and adds value to the organization.
- Assesses team members' performance, strengths, and development needs in a timely manner to provide the direction and support needed to keep the work on track.
- Holds individuals accountable for their performance by providing feedback in a balanced, constructive, and encouraging manner, acknowledging what is working and identifying the changes needed to address what is not working.

- Works with individuals to create a development plan that addresses identified performance gaps and career development priorities, e.g., further training, job shadowing, mentoring, etc., or reallocates them to a position that matches their strengths.
- As team lead, accepts accountability for the team's performance.
- Conducts formal supervision activities as applicable, e.g., performance reviews, objective setting, and recommendations regarding promotions.
- Displays appropriate coaching skills to deal with ad hoc personnel issues.

Knowledge required for competency at this level:

- Working knowledge of relevant labour laws
- Comprehensive knowledge of the management of multidisciplinary teams of experts
- Working knowledge of relationship building and management techniques, e.g., French and Raven's power model
- Working understanding of motivational techniques

3.5.5 Data Generation & Analysis

Collects, generates, analyzes, and manages research data according to approved standards and model practices in order to ensure data integrity and to optimize the value of the data.

Competency in this role is demonstrated when the individual:

- Develops advanced methods for data analysis.
- Accurately interprets the significance and relevance of complex research data.
- Ensures the integrity and security of research data by the implementation and active monitoring of model data protection and accessibility practices.
- Develops policies, processes, and procedures to ensure data quality and integrity. ("Ontario Public Service Careers - Ontario Public Sector Careers")
- Audits documentation from experiments and tests to ensure compliance with research procedures and standards and the integrity of the data generated.
- Adopts documentation procedures to protect intellectual property.

Knowledge required for competency at this level:

- Advanced knowledge of mathematical and statistical concepts and practices
- Advanced knowledge of statistical/analysis software

3.5.6 Applying Model Laboratory Practices

Applies knowledge, skills, and model laboratory practices related to the scientific and technical components of laboratory testing, the use and storage of samples and reagents, the proper handling and disposal of waste products generated during research activities, and the use, maintenance, and calibration of instruments and equipment in order to produce optimal research results in a safe, effective, and efficient manner.

Competency in this role is demonstrated when the individual:

- Ensures that staff are professionally trained in and comply with current model laboratory techniques and practices.
- Ensures that currently accepted scientific and laboratory concepts and theories are integrated and applied to laboratory operations.
- Ensures staff compliance with policies, processes, and procedures for safe handling of reagents, samples, supplies, and waste products.
- Oversees the policies, processes, and procedures for the maintenance, calibration, repair, and replacement of laboratory instruments and equipment.
- Implements procedures for processing and storing sensitive/hazardous materials, e.g., seed/cell banks for biological materials used in the laboratory.

Knowledge required for competency at this level:

- Comprehensive understanding of Good Laboratory Practices (GLP)
- Comprehensive understanding of WHMIS
- Comprehensive understanding of the organization's laboratory policies and procedures

3.5.7 Managing Quality in R&D

Implements and monitors the standard quality management processes to ensure that all R&D activities are conducted according to required standards and create reproducible results in the tests performed, the data generated, the results reported, and the products and technologies created.

Competency in this role is demonstrated when the individual:

- Implements a quality control plan and standard operating procedures, following best practices for all R&D processes and activities.
- Keeps adequately detailed records of all experimental procedures, data, and data analysis.
- Ensures staff compliance with record-keeping procedures.
- Ensures that appropriate and timely corrective action is taken when made aware of noncompliant R&D practices.
- Ensures that any deviance or proposed changes to R&D procedures comply with required quality control standards.
- Ensures staff adhere to the guidelines of the organization's Quality Management System (QMS) and regulated quality standards.
- Develops formal training and SOPs for the handling of all tools, materials, and resources used and waste products generated during R&D activities.

Knowledge required for competency at this level:

- Working knowledge of QMSs and best practices
- Working knowledge of quality assurance tools such as flowcharts, check sheets, Pareto diagrams, cause and effect diagrams, histograms, scatter diagrams, and control charts
- Familiarity with organizational data integrity processes, e.g., lab notebooking, data storage formats and locations

3.5.8 Professional Writing for R&D

Develops and publishes scientific reports and other technical documents to chronicle and advance the body of R&D knowledge. Also creates project reports to ensure that all relevant R&D information is tracked and available to stakeholders as required and to demonstrate compliance with all regulatory requirements.

Competency in this role is demonstrated when the individual:

- Develops synopses of scientific papers, documents, and/or reports to provide base knowledge and guidance for R&D projects.
- Uses clear, plain language to provide a written interpretation of complex technical information for the understanding of a non-technical audience.
- Prepares scientific reports in accordance with professional standards to chronicle R&D processes and findings and to demonstrate compliance with all regulatory requirements.
- Explains the impact of scientific results on project and organizational goals.

Knowledge required for competency at this level:

- Fluency in English or French language and grammar as applicable
- Comprehensive knowledge of technical and scientific document structure
- Working understanding of how to communicate complex scientific ideas and results together with their impact on the project/organization in clear, plain language
- Awareness of language in documentation that may impact staffing, political, and financial resources

3.5.9 Digital Skills for R&D

Makes effective use of Internet and computer software to identify existing scientific activity relevant to the area of study, investigate the depth and breadth of that research, record and maintain data, develop and disseminate reports and presentations, etc.

Competency in this role is demonstrated when the individual:

- Develops strategies to manipulate web databases to gather information in the most effective way and to identify data gaps.
- Uses Microsoft Excel or an equivalent spreadsheet software to organize and analyze data for inclusion in records, reports, and filings.
- Uses Microsoft Office or an equivalent organizational software for record-keeping purposes to keep experiments/data trackable and accessible for all users.
- Uses specialized data analysis software as appropriate to project needs, e.g., Design of Experiments, Spotfire, GraphPad Prism, etc.

- Successfully navigates existing and emerging technologies and electronic tools required for tracking and reporting R&D projects and budgets, such as SAP for budget, and Microsoft Excel, Provantis, and SigmaPlot for reporting.
- Uses the Internet to file complex technical documents and reports.
- Trains/advises others on the use of lab equipment software.

Knowledge required for competency at this level:

- Comprehensive knowledge and skill in the application of the Microsoft Office Suite and Google Analytics
- Comprehensive knowledge and skill in the use of the Internet and scientific data bases for targeted research
- Working knowledge of software applications used within the organization such as ERP, eQMS and CRM and their compliance requirements

3.5.10 Knowledge Transfer

Shares and disseminates technical or scientific knowledge, experience, and ideas from one individual or source to other individuals, groups, or organizations for purposes such as building others' knowledge, training them in a new process, ensuring reproducibility in the event of absence, creating efficiencies, preserving corporate memory, and providing a foundation for scientific collaboration and development.

Competency in this role is demonstrated when the individual:

- Uses multi-mode training tools such as Microsoft PowerPoint, screen-sharing, webinar applications, etc. to disseminate technical information and knowledge.
- Coaches others on more complex tasks such as undertaking a specific aspect of an experiment, using specialized equipment, accessing customized data bases, etc.
- When appropriate, applies the basic steps of effective training (i.e., describe, demonstrate, observe and delegate).
- Documents R&D projects, detailing elements such as history, approvals, objectives, processes trialed, and results achieved for corporate memory and future efficiencies.
- Assists in the development of formal training and SOPs for the handling of all tools, materials, and resources used and waste products generated during R&D activities.

Knowledge required for competency at this level:

- Basic understanding of adult learning principles such as respect for the learner, relevance for the learner, building on prior learning, etc.
- Working understanding of how to apply the basic steps in effective training

3.6 Industry regulatory competencies list for Research Scientist in Bio-Health

3.6.1 Legal/Regulatory Compliance in R&D

Manages R&D documents, data, processes, and procedures in accordance with relevant safety, security, and ethical protocols—including intellectual property protection—to ensure legal protection and regulatory compliance.

Competency in this role is demonstrated when the Individual:

- Audits all aspects of R&D projects to ensure compliance with applicable policies and regulatory requirements.
- Ensures staff compliance with regulatory requirements and guidelines in R&D activities.
- Ensures processes are in place to protect the safety and security of informatics as per GDPR standards.
- Manages contractual instruments to ensure compliance by contract staff and R&D partners.
- Identifies critical R&D processes and product attributes to be included in intellectual property protection applications.
- Determines which legal documentation is required such as consent forms and NDAs.
- Continually monitors current regulatory guidance to facilitate compliance.

Knowledge required for competency at this level:

- Comprehensive knowledge of the organization's regulatory framework
- Thorough knowledge of all legal and regulatory requirements relative to the organization's operations from sources such as the FDA, USDA, CFIA, Health Canada, Province, etc.
- Working understanding of IP development and protection
- If involved in clinical studies, comprehensive knowledge of good clinical research practices, regulatory requirements for studies, and types of data required to obtain regulatory approval for a product
- Comprehensive knowledge of ISO and other relevant world standards and the guiding principles behind them

- Working knowledge of WHMIS and Workplace Health & Safety, as applicable
- Working knowledge of corporate HR policies
- Working knowledge of how the FDA and Health Canada are structured
- Comprehensive knowledge of extant drug regulations such as ICH (International Council for Harmonisation)

3.7 Personal and professional competencies list for Research Scientist in Bio-Health

3.7.1 Collaboration

Works effectively with others to foster trust and cooperation in the achievement of R&D goals and project objectives.

Competency in this role is demonstrated when the individual:

- Identifies the personal interests of clients and other key stakeholders in the success of the R&D program or project to better engage them in achieving program/project goals.
- Creates an environment of trust and mutual respect with relevant colleagues and stakeholders over whom they have no formal authority by consulting them in key decisions and taking their views, expectations, and priorities into account.
- Solicits feedback throughout the project from project staff and stakeholders to proactively identify potential issues.
- Seeks to understand difficult situations and issues from others' perspectives, providing support where necessary to move things forward.
- Continuously coordinates with internal colleagues, clients, suppliers, investors, regulators, etc. to effectively achieve goals and responsibilities.
- Liaises between key project groups such as laboratory staff, informatics researchers, sales and marketing, manufacturing, and collaborators to enable and facilitate the efficient flow of data and resources.

Knowledge required for competency at this level:

- Working knowledge of effective collaboration models and techniques
- Working knowledge of change management resources to affect staff culture, e.g., Kotter's 8-Step Change Model

3.7.2 Continuous Learning

Continuously undertakes introspection in order to understand their current knowledge and skills in a changing environment, recognize personal knowledge gaps, undertake independent action to actively seek targeted opportunities to acquire new knowledge, and reflect on how new knowledge can be integrated and applied.

Competency in this role is demonstrated when the individual:

- Uses feedback and self-reflection to identify knowledge gaps and development opportunities.
- Attends scientific symposia and conferences to address technical knowledge gaps and stay abreast of current theories and advances in the field of R&D.
- Actively pursues opportunities to develop and sharpen personal and professional skills and competencies.
- Dialogues with research experts and industry leaders to become informed of trends and future directions in R&D practices and policies.
- Integrates acquired knowledge of relevant advances and best practices into own R&D work.

Knowledge required for competency at this level:

- Working knowledge of latest adult learning principles as related to learning processes and techniques
- Working knowledge of training resources that can be utilized for personal and professional development
- Working understanding of personal learning style

3.7.3 Critical Thinking/Decision-Making in R&D

Analyzes, synthesizes, and evaluates arguments, information, and data. Also exercises sound judgement in order to solve problems and make decisions that strategically benefit the laboratory/organization's R&D activities and strategy.

Competency in this role is demonstrated when the individual:

- Engages in scientific discussions with peers through journal clubs, debates, etc. to hone critical thinking skills and evaluate scientific developments.
- Seeks opinions from scientists with different areas of expertise to explore other perspectives on new scientific concepts.
- Seeks opinions and validation of the practicality of the research/development solution in light of the organization's objectives.

- Uses experience and logic to evaluate and refine creative options and solutions.
- Explores new scientific technologies and approaches to determine their applicability considering competitive products and technological advances.
- Recommends a course of action based on an analysis of preliminary and incomplete information when action must be taken immediately.
- Uses creative processes such as mind mapping, brainstorming, and visualization to generate options.
- Uses creativity and imagination to view issues from a new perspective and create revolutionary breakthroughs.
- Synthesizes information from multiple sources to formulate entirely new ideas and products.
- Utilizes the power of chance happenings to create new products such as the development of penicillin from mold and the invention of Post-it Notes.

Knowledge required for competency at this level:

- Working understanding of problem-solving frameworks and techniques
- Working understanding of root cause analysis tools such as the Ishikawa diagram or the 5 Whys method
- Working understanding of systems thinking approaches
- Working understanding of the organization and its relationship to the larger economic and political environment

3.7.4 Effective Interpersonal Communication

Communicates in ways that create shared understanding, generate support for the achievement of goals and objectives, and facilitate conflict resolution and problem-solving.

Competency in this role is demonstrated when the individual:

- Delivers multi-mode communications that convey a clear understanding appropriate to the target audience and context, e.g., using plain language to communicate technical research details to a non-technical audience.
- Uses persuasive language to ethically advocate for R&D program/project goals and objectives while still allowing others room to share their opinions.
- Invites participative decision making where appropriate, encouraging input from staff.

- Uses discretion and integrity to resolve conflict with a resistant audience in a manner that maintains a positive working relationship.
- Provides regular project updates in meetings with funders or other stakeholders.
- Makes scientific presentations at advisory boards, key scientific meetings, and external committee meetings.
- Develops strategies to communicate nonconfidential and confidential information appropriately.

Knowledge required for competency at this level:

- Working knowledge of communication and conflict management models
- Working knowledge of change management resources to affect staff culture, e.g., Kotter's 8-Step Change Model
- Working understanding of how to communicate complex scientific ideas and results together with their impact on the project/organization in clear, plain language

3.7.5 Professionalism/Emotional & Cultural Intelligence

Applies emotional and professional sensitivity in order to become aware of their own emotions and those of others they interact with in such a way that they can manage personal and professional decorum and maintain productive relationships.

Competency in this role is demonstrated when the individual:

- Consistently models ethical conduct such as discretion, personal integrity, and respect for diversity to foster cooperation and collaboration in the achievement of organizational objectives (self awareness).
- Exercises initiative to proactively address emerging organizational, regulatory, and technological concerns (self management/regulation).
- Implements positive, personal stress management techniques to effectively deal with stress (self management/regulation).
- Works cooperatively with multiple stakeholders, demonstrating tact, diplomacy, and a willingness to consider alternative approaches or ideas that achieve results within ethical guidelines (relationship management).
- Navigates effectively through personal and political agendas to avoid or overcome barriers to the organization's progress (social awareness).

Knowledge required for competency at this level:

- Working understanding of the principles of emotional intelligence (see the work of authors like Daniel Goleman and Travis Bradberry)
- Working understanding of motivational theories

3.8 Essential Skills for Research Scientist (Bio-Health)

Essential Skills (ES) are foundational skills required for all types of work. They are not technical skills, but the core skills people need to acquire knowledge and complete workplace tasks and daily activities.

Understanding the ES requirements for a role can allow individuals to compare their skills to those required, assist training/learning providers in developing appropriate supports to ensure ES levels are developed during training, and provide employers with an additional tool for determining who/how to place in particular roles.

Human Resources and Skills Development Canada has defined Essential Skills as follows:

- Reading
- Document Use
- Numeracy, which is further divided into:
  - Money math; Scheduling, budgeting, and accounting math; Measurement and calculation math; Data analysis math.
  - Several different factors related to estimations, including the presence of a set procedure, the number of items being estimated, the consequences of errors in estimation, the amount of information missing, and the accuracy required.
- Writing
- Oral Communication
- Thinking Skills, which are further divided into:
  - Problem Solving
  - Decision Making
  - Critical Thinking
  - Job Task Planning and Organizing
  - Finding Information

- Significant Use of Memory
- Digital Skills
- Working with Others
- Continuous Learning

Most of the ES have levels based on complexity, and a role can be analyzed to determine the appropriate levels of ES. The exceptions are noted below:

- "Working with Others" does not have a complexity rating: it simply describes the ways in which the role would be required to interact with other people, either internally within the organization or externally (i.e., with clients, customers, or the public).
- "Continuous Learning" does not have a complexity rating: it describes the types of learning expected in the context of the role (e.g., on the job, being mentored by others, formal training as part of the job, etc.).

NOTE: as of January 2020, ESDC was undertaking a comprehensive review of ES with the intent of adding additional skills, refining existing ones (particularly digital skills) and better aligning ES with similar approaches used in other countries. However the detail was not finalized in time to be used, therefore the profiles developed for this project follow existing standards as of December 2019.

3.9 Canadian Language Benchmark for Research Scientist (Bio-Health)

Canadian Language Benchmarks (CLB) are a 12-point scale for task-based language proficiency descriptors which were originally developed as a guide for measuring the teaching and assessment of English as a Second Language (ESL) learners in Canada. Since they were originally developed, the Canadian Centre for Language Benchmarks (CCLB) has continued to refine CLB, and it now includes scales for both English and French language proficiency. [1]

[1] Centre for Canadian Language Benchmarks. Theoretical Framework for The Canadian Language Benchmarks And *Niveaux De Compétence Linguistique Canadiens.* CCLB. Ottawa 2015. p8

The CLB has been validated against both the Common European Framework for Language (CEFL) and the American Council for the Teaching of Foreign Languages (ACTFL) benchmarks and is considered accurate for high-stakes evaluation[2].

The ES levels for Oral Communication were developed with reference to the Canadian Language Benchmarks[3]. Comparative work to determine the alignment between the CLB and other Essential Skills has been ongoing, with recent work providing additional alignment with the ES for Oral Communication in both spoken and listening domains, Reading, Writing, and Document Use.[4]

CCLB has developed a set of crossover tables that align CLB ratings with ES ratings for reading, writing oral communication and document use.

Research Scientist (Bio-Health) ES/CLB Profile

Essential Skills	Equivalent CLB Level	ES Level				
Reading	Reading: 11–12	1	2	3	4	5
Document Use	Reading: 11–12 Writing: 11–12	1	2	3	4	5
Writing	Writing: 9	1	2	3	4	5
Oral Expression	Speaking: 11–12 Listening: 11–12	1	2	3	4	
Numeracy	n/a	1	2	3	4	5
Thinking Skills – Problem Solving	n/a	1	2	3	4	
Thinking Skills – Decision Making	n/a	1	2	3	4	
Thinking Skills – Job/Task Planning and Organizing	n/a	1	2	3	4	

[2] Centre for Canadian Language Benchmarks. Canadian Language Benchmarks: English as a Second Language for Adults, CCLB. Ottawa 2012 p.II
[3] Essential Skills Research Group. Readers Guide to the Essential Skills. ESDC. Ottawa ND. p57
[4] Canadian Centre for Language Benchmarks. Relating Canadian Language Benchmarks to Essential Skills: A Comparative Framework. 2015, p3

Essential Skills	Equivalent CLB Level	ES Level
Thinking Skills – Significant Use of Memory	n/a	Types 1,2,3
Thinking Skills – Finding Information	n/a	1 2 3 4
Digital Skills	n/a	1 2 3 4 5
Working with Others	n/a	See Below
Continuous Learning	n/a	See Below

Explanation of the Essential Skills and the Canadian Language Benchmark for Research Scientist in Bio-Health

Reading: ES 5 CLB: 11–12

Research Scientists read and interpret a wide variety of dense and complex technical and scientific documentation, including studying scientific research papers and articles in peer-reviewed journals, conducting systematic literature reviews to identify potential areas of focus for the organization's R&D program, and interpreting the significance and relevance of complex scientific research data.

Document Use: ES 5 CLB: Reading: 11–12, Writing: 11–12

Research Scientists access and interpret information from a wide variety of digital and paper-based sources and uses the information gathered to make inferences and draw conclusions within their area of scientific specialization. They must interpret information presented textually, graphically, and numerically and synthesize and summarize information to inform their own research, as well as to inform decisions by others in the organization.

Writing: ES 4 CLB: 9

Research Scientists compose and publish scientific research reports in peer-reviewed science journals and also creates a variety of technical documents including research project reports, summaries of research (their own and others'), and documentation of experiments. They may also contribute to writing funding proposals for research projects from both internal and external sources

(government, foundation) and document the results of R&D efforts so that financial personnel can claim government subsidies and incentives (SRED, etc.) for tax purposes.

Oral Expression: ES 4 CLB: Speaking: 11–12, Listening: 11–12

Research Scientists work within an interdisciplinary team and must be adept at communicating complex technical and scientific information to a wide variety of audiences both inside and outside their organization. They contribute to peer forums, provide information to inform the decisions of senior managers and other stakeholders, instruct junior personnel in techniques and technologies, and solicit feedback from research project staff and stakeholders. Additionally, they make scientific presentations at advisory boards, regulatory bodies, and other external stakeholders. They instruct others on research techniques and protocols, and may be called upon to communicate the details of scientific and technical research to non-technical audiences.

Numeracy: ES 4 (Money Math: n/a, Scheduling, Budgeting and Accounting: 3, Measurements & Calculation: n/a, Data Analysis: 4)

Research Scientists are responsible for formulating and tracking budgets for research grants, as well as tracking project expenditures for ongoing projects. In the course of their research, they will conduct complex calculations with a wide array of dependent and independent variables. In many cases they will analyze data to predict future results in a climate of uncertainty, where the consequences of mistakes can be dire.

Thinking Skills:

Thinking skills are subdivided into five domains:

- Thinking Skills — Problem Solving
- Thinking Skills — Decision Making
- Thinking Skills — Job/Task Planning and Organizing
- Thinking Skills — Finding Information
- Thinking Skills — Significant Use of Memory

- Thinking Skills — Problem Solving: ES 4

Research Scientists solve complex, multi-variate problems in the course of their work. They deal with problems of a scientific and technical nature where the interactions among variables may be unknown or unpredictable, and they must develop a process for solving these problems in order to optimize the outcomes.

- Thinking Skills — Decision Making: ES 4

Research Scientists analyze, synthesize, and evaluates arguments, information, and data and must exercise sound judgement in deciding between alternative courses of action. The decisions they make can have significant and severe consequences for their organization, and the decisions are difficult or impossible to reverse.

- Thinking Skills — Job/Task Planning and Organizing: ES 4

Research Scientists must plan their own work, taking into account the availability of shared resources and potential scheduling conflicts with others. They have wide discretion over the "what and how" of their work and are expected to manage their time to meet specific milestones in a project schedule. They work within an interdisciplinary team to execute research projects that will impact the future of their organization.

- Thinking Skills — Finding Information: ES 4

Research Scientists collect, analyze, and interpret data from a wide array of multidisciplinary scientific and technical resources in the course of their work. Information must be collected and synthesized in order to be used in their research.

- Thinking Skills — Significant Use of Memory: Types 1, 2, 3

Research Scientists must memorize, retain, and use information through one or all of the following methods:

- Purposeful memorization of procedures, codes, parts numbers, memorization through repetition (Type 1)
- Remembering information for brief periods, e.g., minutes or hours (Type 2)
- Unique events in which learning occurs from exposure (Type 3)

Digital Skills: ES 4

Research Scientists utilize standard office productivity software tools (Word processing, spreadsheets, presentations, etc.), electronic communication tools (email, text, instant messaging, video conferencing, etc.), and a variety of data retrieval and analysis tools and technologies in the performance of their duties.

They may use specialized data analysis and statistical software and other specialized digital tools to design, conduct, and analyze their research.

Working with Others: Contexts 1, 3, 4

Research Scientists liaise between key project groups such as laboratory staff, informatics researchers, sales and marketing, manufacturing, and collaborators to enable and facilitate the efficient flow of data and resources. They also continuously coordinate with internal colleagues, clients, suppliers, investors, regulators, etc. to effectively achieve goals and responsibilities. They train others on scientific techniques and management of students/research technicians, so they are required to have working understanding of effective team facilitation skills with an ability to foster trust and cooperation in the achievement of R&D project's goals and objectives. The following work contexts and functions are relevant to the Research Scientist role:

- Works independently (Work Context 1)
- Works jointly with a partner or helper (Work Context 3)
- Works as a member of a team (Work Context 4)

They are also involved in supervisory or leadership activities, as follows: Functions 1–6 & 9–11

Research Scientists make sure the staff are sufficiently trained in policies/procedures related to ethics and conduct. They also recruit and manage a qualified workforce to ensure the organization's R&D program and projects are properly staffed and that the team is managed in a way that fosters not only compliance to requirements and protocols, but also high performance, strong morale, and a high retention rate.

They also hold self and staff accountable to the organization's values, ensuring compliance with the policies and procedures related to scientific ethics and rules of conduct. The following work contexts are relevant to the Research Scientist's role:

- Participate in formal discussions about work processes or product improvement (S/L Function 1)
- Have opportunities to make suggestions on improving work processes (S/L Function 2)
- Monitor work performance of others (S/L Function 3)
- Inform other workers or demonstrate to them how tasks are to be performed (S/L Function 4)
- Orient new employees (S/L Function 5)
- Make hiring recommendations (S/L Function 6)
- Assign routine and new tasks to others (S/L Functions 9 & 10)
- Identify training that is required by or would be useful for other workers (S/L Function 11)

Continuous Learning: Types of Learning 1, 2, 3 How Learning Occurs: 1, 2, 3, 4, 5, 6

Research Scientists are required to continuously learn in order to remain current in the constantly evolving scientific world. They need to recognize personal knowledge gaps and undertake independent action to close them through acquiring and applying new knowledge.

Type of learning may include:

- Training in job-related health and safety (Type 1)
- Obtaining and updating credentials (Type 2)
- Learning about new equipment, procedures, products, and services (Type 3)

The learning may occur:

- As part of regular work activity (Context 1)
- From coworkers (Context 2)
- Through training offered in the workplace (Context 3)
- Through other forms of self-study (Context 4):
    - At work
    - On worker's own time
    - Using materials available through work
    - Using materials obtained through a professional association or union
    - Using materials obtained through worker's own initiative

- Through off-site training (Context 5):
    - During working hours at no cost to the workers
    - Partially subsidized
- With costs paid by the worker (Context 6)

4 REFERENCES

Gathering the data

The development of the National Occupational Standards started with a review of existing information for the role. This review process included: referencing books, job postings, websites, articles, and BioTalent Canada's existing skills profiles to create the first draft. After several iterations via written feedback, focus groups and a national survey with subject matter experts, the National Standards were developed. The following are sources consulted during the creation of the Research Scientist in Bio-Health profile:

"Relating Canadian Language Benchmarks to Essential Skills: A Comparative Framework." Canadian Centre for Language Benchmarks (Ed.), 2015.

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During the research period, several job posting boards were reviewed for this profile.

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