



Australian Government

MSL975014 Perform molecular biology tests and procedures

Release: 1

MSL975014 Perform molecular biology tests and procedures

Modification History

Release 1. Supersedes and is equivalent to MSL975014A Perform molecular biology tests and procedures

Application

This unit of competency covers the ability to isolate, purify, verify and manipulate biomolecules and their products. This work requires close attention to working with small volumes, multiple-step procedures and prevention of contamination. Personnel are required to apply a wide range of molecular biology tests and procedures.

This unit of competency is applicable to technical officers working in manufacturing (e.g. macro, micro, nanotechnology, pharmaceutical and blood products), food, biomedical (e.g. forensics, pathology and veterinary) and environmental industry sectors. Results are generally interpreted and reported to supervising scientists, medical, veterinary or other responsible officers of a workplace, regulatory authority or legal agency.

While no specific licensing or certification requirements apply to this unit at the time of publication, laboratory operations are governed by relevant legislation, regulations and/or external accreditation requirements. Local requirements should be checked.

Pre-requisite Unit

MSL973007 Perform microscopic examination

MSL973004 Perform aseptic techniques

Competency Field

Testing

Unit Sector

Elements and Performance Criteria

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element.

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|---|------------------------------------|-----|--|
| 1 | Interpret and schedule test | 1.1 | Review test request to identify samples to be tested, test method and equipment/instruments involved |
|---|------------------------------------|-----|--|

	requirements	1.2	Identify hazards and workplace control measures associated with the sample, preparation methods, reagents and/or equipment
2	Receive and handle samples	2.1	Log and label samples according to workplace procedures
		2.2	Record sample description, compare with specification and note and report discrepancies
		2.3	Store samples in accordance with workplace and test method requirements
		2.4	Maintain chain of custody, traceable to the worker, for all samples
3	Prepare equipment and reagents	3.1	Set up equipment/instrumentation in accordance with test method requirements and perform pre-use and safety checks
		3.2	Select and collect reagents in accordance with test method requirements
		3.3	Prepare and label reagents in accordance with test method requirements
4	Extract, verify and manipulate biomolecules	4.1	Produce/extract biomolecules from samples using appropriate isolation methods
		4.2	Prevent contamination of samples by unwanted biomolecules
		4.3	Recognise the presence of common inhibitors of biomolecular reactions and take corrective action
		4.4	Quantify and qualify biomolecular yields from purified extractions
		4.5	Use appropriate techniques to prepare and test a range of biomolecular samples
		4.6	Use controls and reference standards to confirm the integrity of biomolecular sample preparation and

procedures

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| 5 | Process data | 5.1 | Record test data noting atypical observations |
| | | 5.2 | Ensure results are consistent with reference standards and expectations |
| | | 5.3 | Record and report results in accordance with test methods |
| | | 5.4 | Interpret trends in data and/or results and report out-of-specification or atypical results promptly to appropriate personnel |
| | | 5.5 | Troubleshoot basic procedure, reagent or equipment problems which have led to atypical data or results |
| | | | |
| 6 | Maintain a safe work environment | 6.1 | Use established safe work practices and personal protective equipment (PPE) to ensure personal safety and that of other laboratory personnel |
| | | 6.2 | Minimise the generation of waste |
| | | 6.3 | Ensure the safe disposal of waste, including hazardous waste and tested samples |
| | | 6.4 | Clean, care for and store equipment and reagents |
| | | | |
| 7 | Report and communicate results | 7.1 | Record approved data into workplace system |
| | | 7.2 | Keep accurate, traceable work records to protect the workplace's intellectual property (IP) rights |
| | | 7.3 | Maintain confidentiality and security of workplace information and laboratory data |
| | | 7.4 | Maintain equipment logs in accordance with workplace procedures |

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Standards, codes, procedures and/or workplace requirements

Standards, codes, procedures and/or workplace requirements include the latest version of one or more of:

- Australian and international standards covering the requirements for the competence of testing and calibration laboratories, laboratory safety, and quality and environmental management
- Australian Standards covering the requirements for safety cabinets; cleaning, disinfecting and sterilising reusable medical and surgical instruments and equipment and maintenance of associated environments in health care facilities; and verification and use of volumetric apparatus
- national work health and safety (WHS) standards and codes of practice, national environmental protection measures, and national measurement regulations and guidelines
- specific codes, guidelines and procedures, such as National Association of Testing Authorities (NATA) accreditation requirements, National Health and Medical Research Council (NHMRC) requirements, principles of good laboratory practice (GLP), Food Standards Australia New Zealand, Australian code of good manufacturing practice for medicinal products (GMP), Therapeutic Goods Regulations, National Registration Authority (NRA), Australian Dangerous Goods Code, Guide to physical containment levels and facility types, and Guidelines for small scale genetic manipulation work from the gene technology regulations
- workplace documents, such as standard operating procedures (SOPs); quality and equipment manuals; calibration and maintenance schedules; material safety data sheets (MSDS) and safety procedures; cleaning, hygiene and personal hygiene requirements; material, client and product specifications; production and laboratory schedules; workplace recording and reporting procedures; and waste minimisation and safe disposal procedures
- sampling procedures (labelling, preparation, storage, transport and disposal), and validated and authorised test methods and

procedures

Molecular biology tests and procedures

Molecular biology tests and procedures include, but are not limited to, one or more of:

- generic techniques, such as:
 - sample digestion, extraction, filtration, separation, dialysis, precipitation and centrifugation
 - accurate and reliable use of micropipettes
 - application of aseptic techniques
 - labelling (e.g. digoxin, fluorescence, enzymes, radioactivity and antibodies)
 - production, labelling and use of DNA probes
- preparation of competent bacterial cells
- preservation and storage of samples (e.g. freezing)
- extraction of nucleic acids, such as:
 - isolation of genomic and plasmid DNA and RNA from samples, such as plants, bacterial suspensions, white blood cells, cheek cells, animal and plant tissue, cultured cells and forensic specimens
 - mini-prep and rapid method isolation of plasmid DNA
 - purification of nucleic acids and proteins:
 - purification of DNA using cesium gradients, commercial purification buffer kits and columns
 - purification of recombinant protein by chromatography
- production of nucleic acids, such as:
 - amplification of DNA by polymerase chain reaction
 - transformation with recombinant DNA
 - identification of transformed organisms with appropriate selection and analytical techniques, such as selective media and insertional inactivation
- use of enzymes, such as:
 - storage and handling of enzymes taking into account segregation, temperature, buffers and labelling to avoid wastage, denaturation and contamination
 - ligation
- analysis of nucleic acids and proteins, such as:
- sequencing DNA
 - assaying of DNA purity and concentration using spectrometric analysis
 - electrophoresis of restriction enzyme digests of plasmid and genomic DNA using agarose gel

- DNA sequencing by Sanger method
- testing using restriction fragment length polymorphism (RFLP), probes and microsatellites
- detection of protein products by measuring activity, including a range of immunological assays
- hybridisations, such as:
 - hybridisation to screen cDNA libraries
 - blotting (southern blots for DNA and Western blots for protein)
- cloning such as:
- cloning and sub-cloning of genes and fragments of DNA
- applications of techniques:
- polymerase chain reaction (PCR)
 - methods to detect gene expression, such as RNA hybridisation, immunological techniques and radioactive labelling
 - testing DNA for sequence variation that is either causative of, or associated with, human disease
 - testing blood for the presence of viruses using the PCR
 - identification of species, such as bacterial contaminants
- generating data for taxonomic and ecological investigations

Corrective action

Corrective action includes:

- purification
- dilution
- additional extraction steps

Safe work practices

Safe work practices include, but are not limited to, one or more of:

- ensuring access to service shut-off points
- recognising and observing hazard warnings and safety signs
- labelling of samples, reagents, aliquoted samples and hazardous materials
- handling and storage of hazardous materials and equipment in accordance with labelling, MSDS and manufacturer instructions
- identifying and reporting operating problems or equipment malfunctions
- cleaning and decontaminating equipment and work areas regularly using workplace procedures
- using PPE, such as gloves, safety glasses, coveralls, gowns, body suits and respirators
- using containment facilities (PCII, PCIII and PCIV physical

containment laboratories), containment equipment (biohazard containers, laminar flow cabinets, Class I, II and III biohazard cabinets) and containment procedures

- reporting abnormal emissions, discharges and airborne contaminants, such as noise, light, solids, liquids, water/wastewater, gases, smoke, vapour, fumes, odour and particulates, to appropriate personnel

WHS and environmental management requirements

WHS and environmental management requirements include:

- complying with WHS and environmental management requirements at all times, which may be imposed through state/territory or federal legislation. These requirements must not be compromised at any time
- applying standard precautions relating to the potentially hazardous nature of samples
- accessing and applying current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and State and Territory Departments of Health, where relevant

Unit Mapping Information

Release 1. Supersedes and is equivalent to MSL975014A Perform molecular biology tests and procedures

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=5c63a03b-4a6b-4ae5-9560-1e3c5f462baa>

Assessment Requirements for MSL975014 Perform molecular biology tests and procedures

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Performance Evidence

Evidence of competence in this unit must satisfy all of the requirements of the elements and performance criteria, and include demonstration of:

- applying at least five (5) molecular biology tests and procedures (including polymerase chain reaction (PCR), ligation and restriction enzyme digestion with appropriate controls) to provide valid, reliable results
- isolating, purifying, verifying and manipulating biomolecules and their products using small volumes and multiple-step procedures
- interpreting and applying test methods consistently and accurately
- safely operating test equipment in accordance with workplace procedures and manufacturer specifications
- preventing and minimising DNA/RNA contamination
- identifying atypical results as out-of-normal range or an artefact
- tracing and sourcing obvious causes of artefacts
- communicating identified problems to a supervisor
- maintaining security, integrity, traceability and identity of samples, sub-samples and work records
- conducting work practices in an ethical and professional manner and in accordance with relevant legislation, regulation and codes of practice
- recording and reporting results in accordance with workplace procedures
- following workplace safety procedures.

Knowledge Evidence

Must provide evidence that demonstrates knowledge of:

- common biotechnology terms
- molecular biology principles and concepts underpinning tests and procedures relevant to job role, including:
 - DNA and RNA structure and function
 - protein structure and function
 - the relationship between chemical and physical properties of nucleic acids and proteins and the techniques used for sampling, preparation and testing
 - replication
 - transcription, translation and gene regulation

- relationship between structure, organisation and function of biomolecules to the storage of information in cells, chromatin, circular and linear chromosomes, RNA, genes and plasmids
- molecular genetics (molecular nature, organisation and function of genes)
- molecular mechanisms of DNA mutation and variation
- DNA transfer in prokaryotes (transformation, conjugation and transduction)
- restriction enzyme and ligase structure, nomenclature, function, specificity and stability, and cohesive versus blunt ends
- ethical issues associated with biotechnology, such as:
 - use of animals for research
 - genetic modification of organisms and food
 - use of gene therapy, cloning and stem cells
 - in vitro fertilisation
 - forensic testing of populations
 - importance of commercial confidentiality, protection of intellectual property (IP) and patents
 - genetic screening of humans
 - sex determination and parentage testing of embryos/humans
- importance and appropriate use of validation methods, controls and certified reference materials
- workplace and/or legal traceability requirements
- relevant hazards, work health and safety (WHS) and environment requirements.

Assessment Conditions

- Judgment of competence must be based on holistic assessment of the evidence. Assessment methods must confirm consistency of performance over time, rather than a single assessment event.
- This unit of competency is to be assessed in the workplace or a simulated workplace environment. A simulated workplace environment must reflect realistic operational workplace conditions that cover all aspects of workplace performance, including the environment, task skills, task management skills, contingency management skills and job role environment skills.
- Foundation skills are integral to competent performance of the unit and should not be assessed separately.
- Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.
- Knowledge evidence may be collected concurrently with performance evidence or through an independent process, such as workbooks, written assessments or interviews (provided a record is kept in each case).
- This unit of competency may be assessed with:
 - MSL974008 Capture and manage scientific images
 - MSL975001 Perform microbiological tests

- MSL975008 Apply electrophoretic techniques
- MSL975009 Apply routine chromatographic techniques
- MSL975013 Perform tissue and cell culture techniques
- MSL975020 Apply routine spectrometric techniques
- Holistic assessment methods include:
 - review of results obtained by the candidate over a period of time to ensure accuracy and consistency
 - review of test records and workplace documentation completed by the candidate
 - feedback from peers and supervisors about the candidate's ability to provide accurate and consistent results within required timelines
 - observation of candidate isolating, purifying, verifying and manipulating biomolecules
 - oral or written questioning covering workplace procedures and technical aspects of molecular biology tests and procedures performed as part of job role.
- Access is required to instruments, equipment, materials, workplace documentation, procedures and specifications associated with this unit, including, but not limited to:
 - a molecular biology laboratory equipped with appropriate test equipment, analytical instruments, standards and reagents
 - workplace procedures, standard methods, manuals and supplier documentation, test results and documentation.
- Assessors must satisfy the assessor competency requirements that are in place at the time of the assessment as set by the VET regulator.
- The assessor must demonstrate both technical competence and currency.
- Technical competence can be demonstrated through:
 - relevant VET or other qualification/Statement of Attainment AND/OR
 - relevant workplace experience.
- Currency can be demonstrated through:
 - performing the competency being assessed as part of current employment OR
 - having consulted with a laboratory about performing the competency being assessed within the last twelve months.

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