Australian Government

Department of Education, Employment and Workplace Relations

MSL975013A Perform tissue and cell culture techniques

Revision Number: 1

MSL975013A Perform tissue and cell culture techniques

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit of competency covers the ability to prepare, maintain and preserve cells and cell lines for a variety of applications, such as large scale culture, production of monoclonal antibodies, production of viral vaccines and amniocentesis studies. Personnel are required to optimise equipment setup, media and growth techniques. They are required to detect and investigate contamination and take preventative and/or corrective actions under supervision.

Application of the Unit

Application of the unit	This unit of competency is applicable to laboratory technicians and technical officers working in laboratories in the biomedical, environmental, biotechnology and education industry sectors. Industry representatives have provided case studies to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. These can be found at the end of this unit of competency under the section 'This competency in practice'.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		
	MSL974006A	*Perform biological procedures*
	MSL973007A	*Perform microscopic examination*
	MSL973004A	*Perform aseptic techniques*

Employability Skills Information

Employability skills	This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Interpret and schedule production requirements	1.1. Review client request and confirm quantity and nature of cells, tissue or products 1.2. Select, appropriate media, materials, equipment and methods 1.3. Plan parallel work sequences to optimise production 1.4. Maintain a chain of custody, traceable to the worker, for all cells and tissues
2. Work safely according to the legal and regulatory framework	2.1. Ensure work practices and personal actions conform to regulations, codes, guidelines and enterprise quality assurance procedures 2.2. Identify hazards and enterprise control measures associated with the sample, preparation methods, reagents and equipment 2.3. Select, fit and use personal protective clothing and safety equipment 2.4. Address hazards and incidents as they arise 2.5. Ensure the safe disposal of biohazardous materials and other laboratory wastes
3. Assemble and maintain tissue culture equipment	3.1. Assemble, sterilise or decontaminate equipment according to enterprise procedures 3.2. Perform pre-use and safety checks in accordance with relevant enterprise and operating procedures 3.3. Identify faulty or unsafe components and equipment and report to appropriate personnel 3.4. Decontaminate area and equipment after use
4. Prepare and test cell and tissue culture media	4.1. Confirm media specifications and processes/methods 4.2. Prepare culture media to suit client request 4.3. Sterilise culture media and check for sterility 4.4. Perform quality control checks to ensure that culture media is fit for purpose 4.5. Store culture media in accordance with specifications
5. Obtain, monitor and maintain tissue and cell lines	5.1. Retrieve/obtain the cell lines or tissue sample from fresh or preserved sources and prepare a culture 5.2. Select specified culture media and add any necessary growth agents or nutrients 5.3. Incubate cells/tissue in specified conditions 5.4. Inoculate the media with the specified amount of sample

ELEMENT	PERFORMANCE CRITERIA
	5.5. Monitor growth of tissue and cell lines and products 5.6. Detect contamination and troubleshoot materials, equipment and techniques 5.7. Passage samples by subculturing to preserve or grow the line 5.8. Harvest cells or cell products to optimise yields
6. Preserve cells and tissues	6.1. Select the appropriate preservation method 6.2. Preserve the cell lines or tissue in accordance with the method 6.3. Check preserved cell lines regularly to ensure viability is maintained
7. Maintain records	7.1. Maintain records of batches of media and test data 7.2. Maintain records of active and stored tissue and cell lines 7.3. Ensure records are retrievable, legible and accurate 7.4. Ensure records conform to the information management, records, quality system and legal requirements

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- working safely and satisfying all legal and regulatory requirements
- preparing, diluting and sterilising reagents and culture media
- choosing media and substrate material based on cost, cleaning, sterilising and maintenance of cell growth
- passaging cell cultures by subculturing
- growing cell lines and tissue to specifications without contaminating the original sample and the environment
- counting cells, identifying a wide range of cell types and contaminants and recognising normal and abnormal cells
- monitoring cell growth and recognising and troubleshooting problems
- storing cells so that they remain viable
- demonstrating chain of custody for all cells, cell lines and tissues
- maintaining accurate, traceable records of cell lines and tissues and logs of procedures and work completed

Required knowledge

Required knowledge includes:

- purposes of cell lines
- normal and abnormal cell morphology
- terminology, such as cell lines, growth media, primary culture, passaging, passage number, subculture, anchorage dependent cells, suspension culture, monolayer, confluent, cell line, cell strain, contact inhibition, diploid and viability
- cell biology (structure, physiology, function, physiological cell growth requirements, nutrient requirements, respiration, temperature and growth cycle)
- critical components of the cell environment and their effects on cell growth, such as pH, temperature, buffering, osmotic pressure, osmolarity, viscosity and foaming
- types of tissue used as source material, such as embryonic, adult or malignant tissue
- techniques for characterising a cell line
- the differences between finite and continuous cell lines
- characteristics of cell culture media and substrates
- nature of substrates (e.g. solid, semi-solid, gel or sponge, glass, disposable plastics and three-dimensional matrices)
- techniques for pre-treating substrates (e.g. feeder layers, chemical treatments, such as poly D-lysine, collagen, gelatine and fibronectin)

REQUIRED SKILLS AND KNOWLEDGE
• role of ingredients in media (e.g. salts, carbohydrates, amino acids, vitamins, hormones, growth factors, serum and antibiotics) • contaminants, such as endotoxins, bacteria, yeast, fungi and Mycoplasma • requirements, typical problems and procedures associated with the production of specific cell lines • relevant health, safety and environment requirements

Evidence Guide

EVIDENCE GUIDE	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors should ensure that candidates can: • work safely and satisfy all legal and regulatory requirements, including the use and care of safety cabinets • demonstrate chain of custody for all cells, cell lines and tissues • prepare, dilute and sterilise reagents and culture media that are fit for purpose • choose and justify appropriate media and substrate material based on cost, cleaning, sterilising and maintenance of cell growth • successfully passage cell cultures by subculturing • grow cell lines and tissue to specifications without contaminating the original sample and the environment • count cells, identify a wide range of cell types and contaminants and recognise normal and abnormal cells • monitor cell growth and recognise and troubleshoot problems, such as contamination • store cells so that they remain viable • maintain accurate, traceable records of cell lines and tissues and logs of procedures and work completed.
Context of and specific resources for assessment	This unit of competency is to be assessed in the workplace or simulated workplace environment. This unit of competency may be assessed with: • *MSL933001AMaintain the laboratory/field workplace fit for purpose.* Resources may include: • laboratory equipped with appropriate test equipment/instruments, standards and reagents • enterprise procedures and standard methods • relevant tissues and cell lines.

EVIDENCE GUIDE	
Method of assessment	The following assessment methods are suggested: • review of records of cell lines and tissues produced by the candidate • periodic observation of the candidate establishing and maintaining viable cell lines • feedback from peers and supervisors to confirm that workplace procedures are consistently followed and that results meet workplace requirements • oral and/or written questioning. In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those aspects of competency which are difficult to assess directly. Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. Access must be provided to appropriate learning and/or assessment support when required. The language, literacy and numeracy demands of assessment should not be greater than those required to undertake the unit of competency in a work like environment.
This competency in practice	Industry representatives have provided the case studies below to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. **Biotechnology** A laboratory technical officer works at a research institute that genetically modifies myocardial cell lines to express Angiotensin II receptors and modify their action. Their role in the team is to grow the cells. This involves selecting the appropriate media, growth conditions and equipment and carefully monitoring cell growth. Each day, they visually check the cells and, when necessary, modify pH, temperature, buffering, osmolarity and substrates to enhance growth. The technical officer keeps accurate and legible records of cells, cell lines, tissues, observations and details of all modifications so that the team has a complete, reliable record of all work done.

EVIDENCE GUIDE	
	Biomedical A laboratory technical officer works at a metropolitan pathology laboratory. Their role is to prepare and use cell cultures for the initial isolation of viruses, such as the herpes simplex (HSV I and II). They routinely subculture human embryonic lung (HEL) cells using appropriate media, flasks and aseptic techniques in a Class II biohazard cabinet. They inoculate each flask with 0.1mL of patient swab washings and incubate them at 37°C for seven days. They also use appropriate positive and negative controls as required by the laboratory's quality assurance procedures. Each day, the technical officer examines the cell monolayer for distinctive changes (cytopathic effect). When the effect is detected, they seek confirmation of the changes from a senior technician. The flask is then sent for immunofluorescent testing to identify the virus isolate.

Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
Codes of practice	Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used

Standards, **codes**, **procedures and/or enterprise requirements**	Standards, codes, procedures and/or enterprise requirements may include:
	• Australian and international standards, such as:
	  • AS 1678 Emergency procedure guide -Transport
	  • AS 2252 Biological safety cabinets
	  • AS ISO 17025-2005 General requirements for the competence of testing and calibration laboratories
	  • AS/NZS 2243 Set:2006 Safety in laboratories set
	  • AS/NZS 2982.1:1997 Laboratory design and construction - General requirements
	  • AS/NZS 4187:2003 Cleaning, disinfecting and sterilising reusable medical and surgical instruments and equipment, and maintenance of associated environments in health care facilities
	  • AS/NZS ISO 14000 Set:2005 Environmental management standards set
	  • AS/NZS ISO 9000 Set:2008 Quality management systems set
	• Australian code of good manufacturing practice for medicinal products (GMP)
	• Australian Dangerous Goods Code
	• client and product specifications
	• enterprise procedures, standard operating procedures (SOPs) and quality assurance procedures
	• gene technology regulations

RANGE STATEMENT	
	• Guide to physical containment levels and facility types • HB 9-1994 Occupational personal protection • laboratory manuals • manufacturer's instructions or verbal direction from laboratory manager, supervisor or senior technician • material safety data sheets (MSDS) • National Code of Practice for the labelling of workplace substances [NOHSC:2012 (1994)] • occupational health and safety (OHS) national standards and codes of practice • operation and maintenance manuals for automated media preparation equipment • quality assurance procedures • principles of good laboratory practice (GLP) • production schedules and instructions • Therapeutic Goods Regulations 1009 • verified test methods
Hazards	Hazards may include: • biohazards, such as infectious agents and oncogenic DNA • chemical and radiation hazards • allergenic factors • cryogenic liquids, such as nitrogen • heat from burners and molten agar • ultraviolet (UV) light • sharps • contaminated clothing
Hazard control measures	Hazard control measures may include: • 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's instructions • identifying and reporting operating problems or equipment malfunctions • cleaning and decontaminating equipment and

RANGE STATEMENT	
	work areas regularly using enterprise procedures • using personal protective clothing and equipment, 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/waste water, gases, smoke, vapour, fumes, odour and particulates to appropriate personnel
Tissue culture equipment and facilities	Tissue culture equipment and facilities may include: • growth cabinets • culture vessels, growth chambers, sterile containers, culture plates, flasks and bottles • autoclaves • positive filtration apparatus • auto pipettes and pipette pumps • cell counting chambers • incubators, including specialised atmosphere and carbon dioxide • binocular inverted microscope • centrifuges • cryogenic vessels and transfer equipment, and liquid nitrogen
Selection criteria for media, **materials and equipment**	Selection criteria for media, materials and equipment may include: • costs • ease of cleaning or sterilisation • maintenance of cell growth
Pre-use checks	Pre-use checks include: • performing routine maintenance • checks on raw materials and consumables, including use by date, possible contamination and storage conditions

RANGE STATEMENT	
Cells and tissues	Cells and tissues may include: • animal cell lines, such as hybridoma, liver, epidermal, lymphoblastic and fibroblastic • plant cell lines, such as tobacco, arabidopsis, soya bean, tomato, roses and meristomatic tissue • yeasts • fungi • sperm, ova and embryos • adherent and suspension cultures
Preparing a primary culture	Preparing a primary culture may include: • thawing of cryopreserved cells and monitoring of cell recovery • enzymatic disaggregation from tissue • mechanical disaggregation from tissue • primary explant technique • pre-treatment • selection techniques, such as cloning, micromanipulation, use of selective media, density gradient centrifugation, selective adhesion techniques and selective detachment
Monitoring growth of tissue and cell lines	Monitoring growth of tissue and cell lines may include: • identification of normal and abnormal cells viewed using an inverted stereo microscope • recognition of contamination by cytopathic changes to cells, biochemical tests, gene detection and microbiological culture • testing for products, such as insulin • checking growth rates • performing viable cell counts, such as the dye exclusion test, Trypan Blue viability stain to determine percentage viability and total cell concentration • staining and assessment of morphology(e.g. by Giemsa) • karyotype analysis
Preservation of cell lines	Preservation of cell lines may include: • freezing

RANGE STATEMENT	
	• cryopreservation (dry ice and liquid nitrogen)
Records	Records may involve: • paper or laboratory information management systems (LIMS) • cataloguing of all cell lines • stock levels • viability test results
Occupational health and safety (OHS) and environmental management requirements	OHS and environmental management requirements: • all operations must comply with enterprise OHS and environmental management requirements, which may be imposed through state/territory or federal legislation - these requirements must not be compromised at any time • all operations assume the potentially hazardous nature of samples and require standard precautions to be applied • where relevant, users should access and apply current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and State and Territory Departments of Health

Unit Sector(s)

Unit sector	Testing

Competency field

Competency field	

Co-requisite units

Co-requisite units		