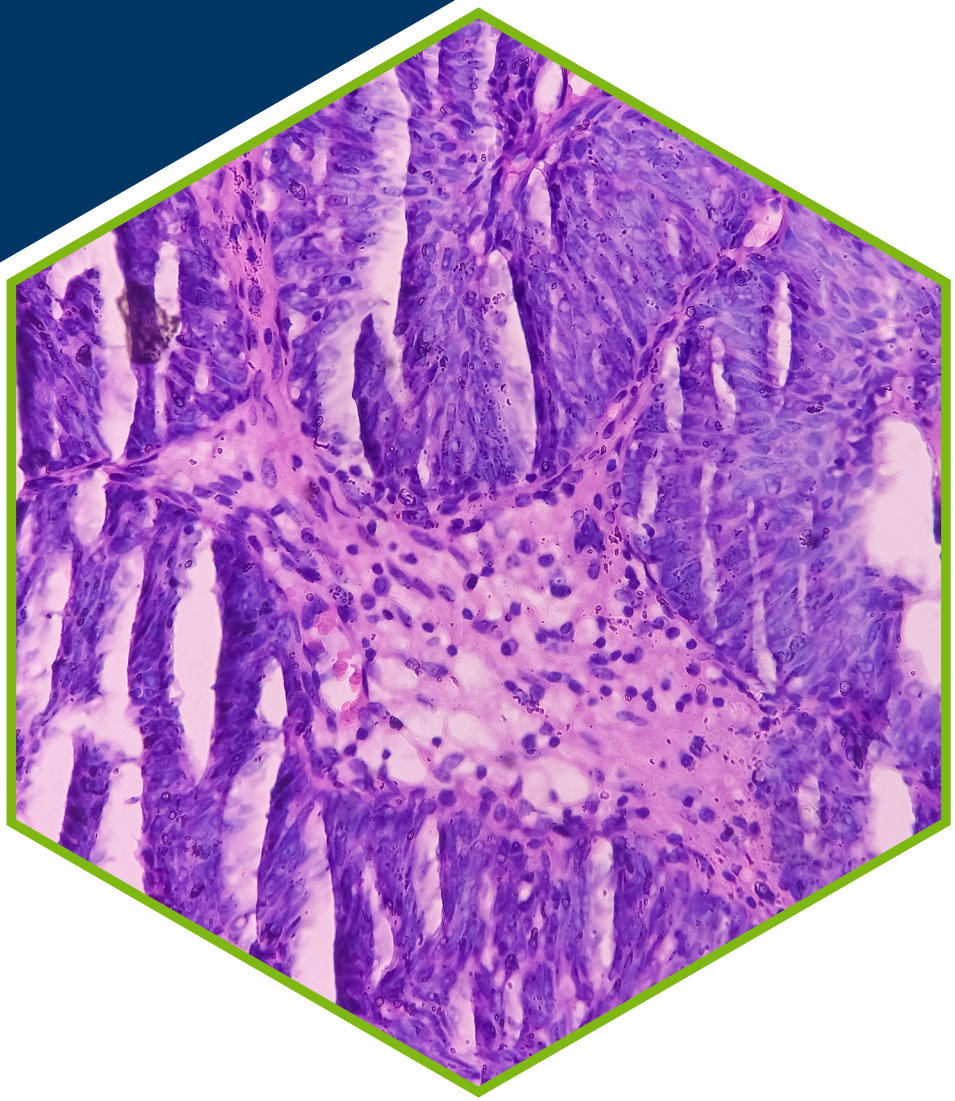
CELLULAR PATHOLOGY DIGITAL SPECIALIST PORTFOLIO



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Cellular Pathology Digital Specialist Portfolio

Modules Tissue Preparation Techniques

- Tissue Selection
- Decalcification
- Tissue Processing and Embedding
- Fixation
- Cryotomy
- Microtomy

Tissue Specific Pathways

- Breast Histology
- Cardiothoracic Histology
- Endocrine Histology
- Gastrointestinal and Hepatobiliary Histology
- Genitourinary Histology
- Gynaecological Histology
- Head and Neck Histology
- Haematolymphoid Histology
- Osteoarticular and Soft Tissue Histology
- Skin Histology

Specialist Techniques

- Haematoxylin and Eosin (H&E)/Special Staining Technique Theory
- Immunohistochemistry Techniques (IHC)
- Companion Diagnostics
- Molecular Pathology for Cellular Pathology

Microscopy and Image Capture

- Microscopy Techniques
- Digital pathology and Artificial Intelligence

The following specialist techniques are optional and can be selected if these modules are available in your laboratory practice.

Optional Specialist Techniques

- Bone Marrow Trephine
- Central Nervous System (CNS)
- Electron Microscopy
- Mohs
- Muscle and Nerve Biopsies

- Ophthalmic Biopsy
- Rectal Biopsies for Suspected Hirschsprung's Disease

Please note
All learning outcomes (LOs) are met through two pieces of evidence, Q&A as agreed with a training officer and an additional piece of work as selected by the candidate.
A statement of work and reflective statement on each module will be required which will include sign off by the trainer stating that the candidate works in accordance with laboratory procedures, the competence for which should be evidenced in-house and is not part of the portfolio submission.
Indicative Content outlines background knowledge that may be required to meet the LOs and/or knowledge and competences expected to be demonstrated across multiple modules. Knowledge of areas highlighted in the indicative content may be examined during the viva.

Module Title	Tissue Preparation Techniques: Tissue Selection
Module code	7683
Rationale/ Aims	Completion of this module enables the candidate to recognise, apply, and appraise the importance of maintaining the link between specimen and request form. The candidate will work in a safe manner and will demonstrate with examples their ability to perform tissue transfer of category A specimens appropriate to their scope of practice. They will discuss and employ measures taken to avoid specimen mix-up, tissue loss and contamination. Candidates will evaluate the impact of poor orientation of specimens at tissue selection and transfer prior to subsequent tissue preparation procedures. The candidates will assess the impact of pre-analytical errors and provide examples in their ability to troubleshoot common issues.
Learning outcomes	1. Discuss the importance of the use of identifiers on the request form and container to match in avoiding sample mix-up. 2. Demonstrate how your laboratory operates to maintain the link between sample, cassette, and request form including labelling and storage methods. Include how specimens are logged on Laboratory Information Management Systems (LIMS) and/or tracking systems appropriate to your own laboratory. 3. Recognise the hazards associated with tissue selection and explain the appropriate actions to maintain safe working, including steps to take in the event of an incident. 4. Demonstrate how you would set up the dissecting workstation in an ergonomic manner ready for dissection. 5. Demonstrate with examples from your practice the transfer of category A specimens from pot to cassette relative to your own scope of practice, maintaining appropriate audit trail records. 6. Discuss the implications of specimen contamination and missing tissue and demonstrate with examples measures taken in accordance with laboratory protocols at specimen transfer to avoid specimen contamination and tissue loss for subsequent procedures such as processing and microtomy. 7. Explain and apply the importance of correct orientation of samples at specimen dissection and state methods taken to distinguish them in subsequent tissue preparation procedures such as embedding and microtomy. 8. Demonstrate with examples troubleshooting problems which may arise pre and post-analytically, including root cause analysis.
Indicative Content	Candidates require knowledge and understanding of: Situations when specimen contamination may arise and how to avoid them. Equipment, technique, environment. When tissue may require further or alternative fixation methods. Haemorrhagic tissue, high risk specimens, tumour resections, etc.

	Candidates must be able to: Set up dissection bench in preparation for tissue transfer and those performing specimen dissection. Assist in specimen dissections with a range of dissectors and take or set-up equipment used for dictation. Follow SOPs., error logging, Give accurate macroscopic description of category A specimens supported with audit relative to own scope of practice. Take appropriate action in events such as the reporting of missing tissue at tissue transfer in accordance with laboratory protocol. Identify tissue types that require specific orientation at dissection and communicate clearly to the embedder and microtomist the importance of the correct orientation of Epidermis, lumen, serosa, and mucosal walls. Operate and perform basic maintenance on cassette labelling equipment.

Module Title	Tissue Preparation Techniques: Decalcification
Module code	7684
Rationale/ Aims	This module will provide candidates with the knowledge and confidence to handle a range of tissues containing calcium for histological processing. Candidate will gain a clear understanding of the principles and practice of decalcification and how it can be successfully carried out within the laboratory. Candidates will gain knowledge of different decalcifying reagents and their use with different tissue types as well as the safe use and disposal of these reagents.
Learning outcomes	1. Explain the principles of decalcification and the methods available. 2. Discuss when decalcifying agents should not be used and explain why. 3. Describe how decalcification may affect subsequent methods of analysis. 4. Demonstrate with examples the preparation, monitoring and processing of specimens for decalcification, maintaining records and audit trails as appropriate. 5. Demonstrate with examples from practice decalcification procedures on a variety of calcified tissues and explain how to test for completion of decalcification. 6. Discuss the risks and hazards associated with the use and disposal of decalcifying reagents. 7. Demonstrate with examples from practice how to troubleshoot problems which may arise, including root cause analysis as appropriate. 8. Explain the relative merits of decalcifying agents used within cellular pathology and be able to select the appropriate reagent for a range of samples.
Indicative Content	Candidates require knowledge and understanding of: Homeostatic regulation of calcium levels. The pathological significance of calcium in tissue.

Module Title	Tissue Preparation Techniques: Tissue processing and Embedding
Module code	7712
Rationale/ Aims	This module provides candidates with the knowledge and confidence to process, embed, and quality control routine histology tissue samples. Candidate will gain a clear understanding of the principles and practice of tissue processing and embedding histological procedures. Candidates will understand the role of processing and embedding in the investigation of key pathological conditions and how these may be investigated histologically.
Learning outcomes	1. Explain the principles and practice of paraffin wax tissue processing for a range of tissues. 2. Discuss the influence of processing schedules on the quality of sample preservation for subsequent analysis and give an example from practice. 3. Discuss how to troubleshoot processing errors. 4. Compare the advantages and disadvantages of different processing reagents and schedules. 5. Discuss the effects of heat, pressure and vacuum on tissue processing times and tissue morphology. 6. Explain the principles and practice of resin processing. 7. Explain the principles and practice of a range of tissue embedding techniques, and discuss potential errors, and their clinical impact. 8. Appraise the correct orientation for embedding a range of tissues, demonstrate candidates application of this in practice. 9. Discuss the risks and hazards associated with the use and disposal of processing reagents and embedding media.
Indicative Content	Candidate requires knowledge and understanding of: Tissue processing and embedding techniques for routine histology samples EQA schemes for tissue processing and embedding procedures and able to interpret and act upon the results

Module Title	Tissue Preparation Techniques: Fixation
Module code	7685
Rationale/ Aims	This module provides the candidate with an understanding of the changes that cells and tissues undergo when removed from the body, how tissue(s) can be stabilised employing fixation practices as well as how differing approaches can be employed to ensure optimal sample preservation. This module enables the candidate to both explain and demonstrate the processes employed during specimen fixation and how this critical step impacts on all downstream Cellular Pathology processes. Candidates will be able to safely prepare, select and apply a range of techniques and chemical fixatives to samples received in their own laboratories and have a clear understanding of the impact that their choices have on the tissue, the resulting diagnoses made and the potential influence this has ultimately on the management of the patient.
Learning outcomes	1.Describe the changes that cells and tissues undergo when they are removed from the body. 2.Explain the risks associated with the handling of fresh cellular pathology samples (including tissues and fluids) and discuss how these are managed in a laboratory environment. 3.Describe situations when it may be necessary to delay fixation and discuss the challenges this presents and how these can be overcome. 4.Describe the properties and modes of action of different fixatives used in cellular pathology e.g. cross-linking, precipitation, oxidation, and discuss their advantages and disadvantages and the samples on which they are used. 5.Identify practical considerations required when fixing tissues (e.g. penetration rates in differing tissue types) and discuss how these can be overcome. 6. Discuss with examples the impact of fixation on IHC staining patterns. 7.Demonstrate monitoring of hazards associated with fixation and explain why these are necessary. 8. Explain why it is important for samples to be optimally preserved and discuss the impact deterioration can have on patient outcomes / management. 9. Discuss common technical issues which may arise during fixation including their root cause(s) and how these may be overcome without compromising sample integrity.
Indicative Content	Candidates require knowledge and understanding of: The deterioration and changes samples undergo once removed from

	the body and how this can be minimised, e.g. autolysis, cooling/freezing, fixation. Situations where delayed fixation of samples may be required and why it is important that fixatives are sometimes not immediately used, e.g. frozen section, genetic analysis, biobanking. A range of different fixation techniques and how these can be applied to tissue samples, e.g. heat, immersion, perfusion, microwave. A range of different chemical fixative agents, how they differ and how they can be applied to a variety of tissue samples, e.g. common fixatives e.g. formaldehyde, glutaraldehyde, specialist fixatives, buffering and pH, impact of temperature, fixation artefacts, awareness of tissue penetration time, diffusion rate. Methods to improve penetration time e.g. slicing. The health and safety considerations that apply to both the practice of sample fixation and the chemical(s) employed in tissue fixation. COSHH. Risk Assessment. Environmental monitoring. The impact of poor sample preservation on patient management and outcomes, e.g. interpretive/diagnostic issues. Impact on reflex testing e.g. IHC. Candidates must be able to: Prepare, handle and safely use a range of commonly available fixatives within a laboratory environment. Make up fixatives. Use fixatives. Dispose of fixatives.

Module Title	Tissue Preparation Techniques: Cryotomy
Module code	7686
Rationale/ Aims	This module provides the candidate with an understanding of the principles and practice of producing tissue sections for subsequent staining and evaluation using a cryostat. The candidate will gain knowledge and understanding of processes employed during the production of high-quality tissue sections suitable for routine staining, special stains, IHC, FISH etc. Candidates will be able to produce suitable sections from a variety of tissues and will be able to use their knowledge and understanding to recognise and remedy common faults. Candidates will be able to produce sections appropriate to the tissue and pathology under investigation.
Learning outcomes	1. Explain the principles and practice of cryotomy, comparing and contrasting its use with microtomy. 2. Identify and discuss the risks and hazards associated with cryotomes and the difference in risk from microtomy – with particular reference to unfixed specimens. 3. Discuss application of frozen sections in cellular pathology, and its role in patient management. 4. Explain workings of a cryostat and principles of rapid freezing of tissues and discuss how this relates to ice crystal artefact. 5. Describe a range of diagnoses that may be made on frozen sections and explain why frozen section is required. 6. Demonstrate preparation of high-quality cryostat sections and include examples of when it would be appropriate to seek assistance/advice and give the rationale. 7. Demonstrate, with examples from candidates practice, how to orientate and freeze tissues appropriately. 8. Discuss the importance of preparing frozen sections in a timely manner for 'intra-operative' diagnosis. 9. Demonstrate decontaminating cryostats appropriately. 10. Identify problems which may arise during cryotomy and demonstrate troubleshooting as appropriate.
Indicative Content	Candidates require knowledge and understanding of: Awareness of the main role of crytotomy and intraoperative diagnosis for a range of conditions. Samples that cannot be processed, e.g., fat related pathology. Health and safety considerations beyond that required for microtomy. Standard staining of frozen sections. Rapid H&E, enzyme histochemistry etc.

	Candidates must be able to: Produce high quality samples within an appropriate time frame. Recognise and correct common artefacts.

Module Title	Tissue Preparation Techniques: Microtomy
Module code	7687
Rationale/ Aims	This module will enable the candidate to both explain and demonstrate the processes employed during the production of high-quality tissue sections, suitable for routine staining, special stains, IHC, FISH etc. Candidates will be able to produce suitable sections from a variety of tissues. They will be able to use their knowledge and understanding to recognise and remedy common faults. They will be able to produce sections appropriate to the tissue and pathology under investigation e.g., appropriate section thickness, use of coated slides, taking unstained sections for later use.
Learning outcomes	1. Explain the principles and practice of microtomy, and discuss the advantages and disadvantages of different types of microtomes for the production of tissue sections. 2. Recognise the hazards associated with microtomes and explain the appropriate actions to maintain safe working, including steps to take in the event of an incident. Demonstrate setting up your personal workstation in an ergonomic manner. 3. Demonstrate the practice of section mounting e.g., location and number of sections on slides with relation to underlying principles, and discuss the use of coated slides for different applications. 4. Demonstrate with examples from practice good quality sections. Discuss the implications of poor-quality sections and common causes for unsuitable sections and how to remedy them. 5. Discuss the histological significance and impact on patients of sections which inappropriately demonstrate the area of interest, e.g. full face. 6. Explain the clinical rationale underpinning the examination of multiple levels. 7. Demonstrate appropriate orientation of tissues at embedding to identify the necessary histological features for diagnosis, and discuss the impact and importance of appropriate block and tissue orientation for microtomy. 8. Demonstrate troubleshooting of microtomy problems which may arise, include root cause analysis as appropriate.
Indicative Content	Candidates require knowledge and understanding of: Different types of microtomes, how and when they might be used. Rotary, sledge, rocker etc. How different tissue types may need different approaches. Lymph node, fatty tissue, suspected amyloid samples. Standard sets of special investigations. Cutting multiple sections for medical liver or renal biopsies. Candidates must be able to: Select the correct slides for different samples.

	Coated or charged slides for special investigations. Recognise and correct common artefacts. Scores, chatters, thick/thin etc. Follow standard operating procedures for levels, serials, section coils/curls, and step sections appropriately to cut a range of tissue sections to the required standard, maintaining appropriate audit trail records.

Module Title	Tissue Specific Pathways: Breast Histology
Module code	7691
Rationale/ Aims	This module provides the candidate with the knowledge and confidence to prepare, process and stain breast histology samples. Candidates will gain a clear understanding of the anatomy and physiology of breast tissue, the pathological basis of disorders of breast tissue and how these may be investigated histologically.
Learning outcomes	1. Discuss how the anatomy and pathophysiology of breast tissue interacts. 2. Discuss how pathological processes including inflammation, neoplasia, and infection relate to breast tissue. 3. Explain when and why samples of breast tissue need to be prepared prior to dissection, as well as how this should be done. 4. Explain dissection/tissue selection protocols and block selection rationale for samples of breast tissue, as relevant to your laboratory. 5. Describe how normal and abnormal breast tissue stained using Haematoxylin and Eosin (H&E) should appear when viewed with a microscope, use examples relevant to your practice. 6. Explain when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities of breast tissue; identify all the relevant stains and techniques. 7. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above – use examples relevant to your practice. 8. Demonstrate how you are involved in any part of the process between tissue preparation and reporting for a breast tissue sample. 9. Discuss how cellular pathology investigations impacts the management of patients with breast disorders.
Indicative Content	Candidates require knowledge and understanding of: Tissue preparation techniques for samples of breast tissue. Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for samples of breast tissue. Quality control for basic (H&E) and advanced (IHC, special staining, companion diagnostics) stains that may be utilised for samples of breast tissue. EQA schemes for staining techniques associated with breast tissue. Tissue retention requirements related to samples of breast tissue. The principles of tumour grading and staging with respect to breast tissue samples.

	Invasive and non-invasive surgical procedures and their relationship to the collection of breast tissue samples. Candidates must be able to use microscopes.

Module Title	Tissue Specific Pathways: Cardiothoracic Histology
Module code	7689
Rationale/ Aims	This module provides the candidate with the knowledge and confidence to prepare, process, and stain cardiothoracic histology tissue samples. Candidate will gain a clear understanding of the anatomy and physiology of the cardiothoracic system, the pathological basis of disorders of the cardiothoracic system, and how these may be investigated histologically. For the purposes of this module, Cardiothoracic includes: Heart (including valves and pericardium) Pericardia Mediastinum Arteries & Veins Lungs (including pleura/mesothelium)
Learning outcomes	1. Discuss how the anatomy and pathophysiology of cardiothoracic systems interact. 2. Discuss how pathological processes including inflammation, neoplasia, and infection relate to cardiothoracic tissue. 3. Explain when and why samples of cardiothoracic tissue need to be prepared prior to dissection, as well as how this should be done. 4. Explain dissection/tissue selection protocols and block selection rationale for samples of cardiothoracic tissue, as relevant to your laboratory. 5. Describe how normal and abnormal cardiothoracic tissue stained using Haematoxylin & Eosin (H&E) should appear when viewed with a microscope, use examples relevant to your practice. 6. Explain when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities of cardiothoracic tissue; identify all the relevant stains and techniques. 7. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above – use examples relevant to your practice. 8. Demonstrate how you are involved in any part of the process between tissue preparation and reporting for a cardiothoracic tissue sample. 9. Discuss how cellular pathology investigations impacts the management of patients with cardiothoracic disorders.
Indicative Content	Candidates require knowledge and understanding of: Tissue preparation techniques for samples from the cardiothoracic system. Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for samples of cardiothoracic. Quality control for basic (H&E) and advanced (IHC, special staining, companion diagnostics) stains that may be utilised for samples from the cardiothoracic system.

	EQA schemes for staining techniques associated with the cardiothoracic system. Tissue retention requirements related to samples from the cardiothoracic system. The principles of tumour grading and staging with respect to tissue samples from the cardiothoracic system. Invasive and non-invasive surgical procedures and their relationship to the collection of samples from the cardiothoracic system. Candidates must be able to use microscopes.

Module Title	Tissue Specific Pathways: Endocrine Histology
Module code	7690
Rationale/ Aims	This module will provide the candidate with the knowledge and confidence to prepare, process, and stain endocrine histology tissue samples. Candidates will gain a clear understanding of the pathological basis of disorders of the endocrine system, and how these may be investigated histologically. Candidates will be able to microscopically identify normal and abnormal tissue and understand the variety and applications of stains used in the investigation of endocrine histology. For the purposes of this module Endocrine include: • Thyroid • Parathyroid • Pancreas • Adrenal
Learning outcomes	1. Discuss how the anatomy and pathophysiology of endocrine systems interact. 2. Discuss how pathological processes including inflammation, neoplasia, and infection relate to endocrine tissue. 3. Explain when and why samples of endocrine tissue need to be prepared prior to dissection, as well as how this should be done. 4. Explain dissection/tissue selection protocols and block selection rationale for samples of endocrine tissue, as relevant to your laboratory. 5. Describe how normal and abnormal endocrine tissue stained using Haematoxylin and Eosin (H&E) should appear when viewed with a microscope, use examples relevant to your practice. 6. Explain when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities of endocrine tissue; identify all the relevant stains and techniques. 7. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above – use examples relevant to your practice. 8. Demonstrate how you are involved in any part of the process between tissue preparation and reporting for an endocrine tissue sample. 9. Discuss how cellular pathology investigations impacts the management of patients with endocrine disorders.
Indicative Content	Candidates require knowledge and understanding of: Tissue preparation techniques for samples from the endocrine system. Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for samples from the endocrine system. Quality control for basic (H&E) and advanced (IHC, special staining, companion diagnostics) stains that may be utilised for samples from the

	endocrine system. EQA schemes for staining techniques associated with the endocrine system. Tissue retention requirements related to samples from the endocrine system. The principles of tumour grading and staging with respect to tissue samples from the endocrine system. Invasive and non-invasive surgical procedures and their relationship to the collection of samples from the endocrine system. Candidates must be able to use microscopes.

Module Title	Tissue Preparation Techniques: Gastrointestinal and Hepatobiliary Histology
Module code	6927
Rationale/ Aims	This module provides the candidate with the knowledge and confidence to prepare, process, and stain gastrointestinal & hepatobiliary histology tissue samples. Candidates will gain a clear understanding of the pathological basis of disorders of the gastrointestinal tract and hepatobiliary system, and how these may be investigated histologically. Candidates will gain understanding of tissue selection protocols and block selection and knowledge and application of stains used in the investigation of gastrointestinal and hepatobiliary histology and be able to identify normal and abnormal tissue. For the purposes of this module Gastrointestinal and Hepatobiliary includes: Anus Small Intestine (including duodenum, ampulla of Vater, and common bile duct) Large intestine and Rectum Appendix Gall Bladder Liver Oesophagus Stomach
Learning outcomes	1. Discuss how the anatomy and pathophysiology of gastrointestinal and hepatobiliary systems interact. 2. Discuss how pathological processes including inflammation, neoplasia, and infection relate to gastrointestinal and hepatobiliary tissue. 3. Explain when and why samples of gastrointestinal & hepatobiliary tissue need to be prepared prior to dissection, as well as how this should be done. 4. Explain dissection/tissue selection protocols and block selection rationale for samples of gastrointestinal and hepatobiliary tissue, as relevant to your laboratory. 5. Describe how normal and abnormal gastrointestinal and hepatobiliary tissue stained using Haematoxylin and Eosin (H&E) should appear when viewed with a microscope, use examples relevant to your practice. 6. Explain when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities of gastrointestinal and hepatobiliary tissue; identify all the relevant stains and techniques. 7. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above – use examples relevant to your practice.

	8. Demonstrate how you are involved in any part of the process between tissue preparation and reporting for a gastrointestinal or hepatobiliary tissue sample. 9. Discuss how cellular pathology investigations impacts the management of patients with gastrointestinal and/or hepatobiliary disorders.
Indicative Content	Candidate requires knowledge and understanding of: Tissue processing and embedding techniques for routine histology samples EQA schemes for tissue processing and embedding procedures and able to interpret and act upon the results

Module Title	Tissue Specific Pathways: Genitourinary Histology
Module code	7693
Rationale/ Aims	This module aims to provide the candidate with the knowledge and confidence to prepare, process and stain genitourinary histology tissue samples. Candidates will gain a clear understanding of the anatomy & physiology and the pathological basis of disorders of the genitourinary system and how these may be investigated histologically. For the purpose of this module, the genitourinary system includes: The kidney and renal pelvis The ureter The bladder The prostate The penis and scrotum The testes The epididymis and spermatic cord.
Learning outcomes	1. Discuss how the anatomy and pathophysiology of the genitourinary system interact. 2. Discuss how pathological processes including inflammation, neoplasia, and infection relate to the genitourinary systems. 3. Explain when and why samples from the genitourinary system need to be prepared prior to dissection, as well as how this should be done. 4. Explain dissection/tissue selection protocols and block selection rationale for samples from the genitourinary system, as relevant to your laboratory. 5. Describe how normal and abnormal tissue from the genitourinary system stained using Haematoxylin and Eosin (H&E) should appear when viewed with a microscope, use examples relevant to your practice. 6. Explain when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities of the genitourinary system; identify all the relevant stains and techniques. 7. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above – use examples relevant to your practice. 8. Demonstrate how you are involved in any part of the process between tissue preparation and reporting for a specimen related to the genitourinary system. 9. Discuss how cellular pathology investigations impacts the management of patients with genitourinary disorders.
Indicative Content	Candidates require knowledge and understanding of: Tissue preparation techniques for samples from kidney, bladder, ureter, urethra, prostate, penis, scrotum, testis, epididymis and spermatic cord.

	Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for samples from the genitourinary system. Quality control for basic (H&E) and advanced (IHC, special staining, companion diagnostics) stains that may be utilised for samples from the genitourinary system. EQA schemes for staining techniques associated with the genitourinary system. Tissue retention requirements related to samples from the genitourinary system. The principles of tumour grading and staging with respect to tissue samples from the genitourinary system Invasive and non-invasive surgical procedures and their relationship to the collection of samples from the genitourinary system. Candidates must be able to use microscopes.

Module Title	Tissue Specific Pathways: Gynaecological Histology
Module code	7692
Rationale/ Aims	This module aims to provide the candidate with the knowledge and confidence to prepare, process and stain gynaecological histology tissue samples. Candidates will gain a clear understanding of the anatomy & physiology and the pathological basis of disorders of the gynaecological system and how these may be investigated histologically. For the purpose of this module, the gynaecological system includes: Uterus Cervix Ovary Fallopian tubes Vulva and Vagina Endometrial specimens Products of conception (pregnancy remains/pregnancy loss).
Learning outcomes	1. Discuss how the anatomy and pathophysiology of the gynaecological system interact. 2. Discuss how pathological processes including inflammation, neoplasia, and infection relate to the genitourinary systems. 3. Explain when and why samples from the gynaecological system need to be prepared prior to dissection, as well as how this should be done. 4. Explain dissection/tissue selection protocols and block selection rationale for samples from the gynaecological system, as relevant to your laboratory. 5. Describe how normal and abnormal tissue from the gynaecological system stained using Haematoxylin and Eosin (H&E) should appear when viewed with a microscope, use examples relevant to your practice. 6. Explain when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities of the gynaecological system; identify all the relevant stains and techniques. 7. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above – use examples relevant to your practice. 8. Demonstrate how you are involved in any part of the process between tissue preparation and reporting for a specimen related to the gynaecological system. 9. Discuss how cellular pathology investigations impacts the management of patients with gynaecological disorders.
Indicative Content	Candidates require knowledge and understanding of: Tissue preparation techniques for samples from uterus, cervix, ovary, fallopian tubes, vulva, vagina, endometrial specimens, myomectomies, products of conception (pregnancy remains/pregnancy loss). Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for samples from the genitourinary system. Quality control for basic (H&E) and advanced (IHC, special staining, companion diagnostics) stains that may be utilised for samples from the gynaecological

	system. EQA schemes for staining techniques associated with the gynaecological system. Tissue retention requirements related to samples from the gynaecological system. The principles of tumour grading and staging with respect to tissue samples from the gynaecological system Invasive and non-invasive surgical procedures and their relationship to the collection of samples from the gynaecological system. Candidates must be able to use microscopes.

Module Title	Tissue Specific Pathways: Head and Neck Histology
Module code	7694
Rationale/ Aims	This module provides the candidate with the knowledge and confidence to prepare, process, and stain head & neck histology tissue samples. Candidates will gain a clear understanding of the pathological basis of disorders of the head and neck, and how these may be investigated histologically. Candidates will gain understanding of the tissue and block selection protocols for head and neck samples and the stains used to view the tissues. Candidates will be able to identify normal and abnormal tissue and understand why different stains are used when investigating head and neck histology. For the purpose of this module Head and Neck includes: Ear, Nose, and Throat Dental Neck & Neck dissections
Learning outcomes	1. Discuss how the anatomy and pathophysiology of the head and neck interact. 2. Discuss how pathological processes including inflammation, neoplasia, and infection relate to the head and neck. 3. Explain when and why samples from the head and neck need to be prepared prior to dissection, as well as how this should be done. 4. Explain dissection/tissue selection protocols and block selection rationale for samples from the head and neck, as relevant to your laboratory. 5. Describe how normal and abnormal samples from the head and neck stained using Haematoxylin and Eosin (H&E) should appear when viewed with a microscope, use examples relevant to your practice. 6. Explain when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities from head and neck samples; identify all the relevant stains and techniques. 7. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above – use examples relevant to your practice. 8. Demonstrate how you are involved in any part of the process between tissue preparation and reporting for a head and neck sample. 9. Discuss how cellular pathology investigations impacts the management of patients with head and neck disorders.
Indicative Content	Candidates require knowledge and understanding of: Tissue preparation techniques for samples from the head and neck. Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for samples from the head & neck. Quality control for basic (H&E) and advanced (IHC, special staining,

	companion diagnostics) stains that may be utilised for samples from the head and neck. EQA schemes for staining techniques associated with the head and neck. Tissue retention requirements related to samples from the head and neck. The principles of tumour grading and staging with respect to tissue samples from the head and neck. Invasive and non-invasive surgical procedures and their relationship to the collection of samples from the head and neck. Candidates must be able to use microscopes.

Module Title	Tissue Specific Pathways: Haematolymphoid Histology
Module code	7695
Rationale/ Aims	This module provides the candidate with the knowledge and confidence to prepare, process, and stain haematolymphoid histology tissue samples. Candidates will gain a clear understanding of the pathological basis of disorders of the lymphatic/haematopoietic system, and how these may be investigated histologically. Candidates will gain knowledge and understanding of the sample types required in the investigation of haematolymphoid histology. Candidates will gain knowledge of different stains used in the investigation of haematolymphoid histology samples and be able to identify normal and abnormal tissue. For the purposes of this module haematolymphoid includes: Spleen Lymph Nodes & vessels Bone Marrow Trephines
Learning outcomes	1. Discuss how the anatomy and pathophysiology of haematolymphoid systems interact. 2. Discuss how pathological processes including inflammation, neoplasia, and infection relate to haematolymphoid tissue. 3. Explain when and why samples of haematolymphoid tissue need to be prepared prior to dissection, as well as how this should be done. 4. Explain dissection/tissue selection protocols and block selection rationale for samples of haematolymphoid tissue, as relevant to your laboratory. 5. Describe how normal and abnormal haematolymphoid tissue stained using Haematoxylin and Eosin (H&E) should appear when viewed with a microscope, use examples relevant to your practice. 6. Explain when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities of haematolymphoid tissue; identify all the relevant stains and techniques. 7. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above – use examples relevant to your practice. 8. Demonstrate how you are involved in any part of the process between tissue preparation and reporting for a haematolymphoid tissue sample. 9. Discuss how cellular pathology investigations impacts the management of patients with haematolymphoid disorders.
Indicative Content	Candidates require knowledge and understanding of: Tissue preparation techniques for haematolymphoid samples. Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for haematolymphoid samples.

	Quality control for basic (H&E) and advanced (IHC, special staining, companion diagnostics) stains that may be utilised for haematolymphoid. EQA schemes for staining techniques associated with haematolymphoid samples. Tissue retention requirements related to haematolymphoid samples. The principles of tumour grading and staging with respect to tissue samples from lymphatic/haematopoietic system. Invasive and non-invasive surgical procedures and their relationship to the collection of samples from the lymphatic/haematopoietic system. Candidates must be able to use microscopes.

Module Title	Tissue Specific Pathways: Osteoarticular and Soft Tissue Histology
Module code	7696
Rationale/ Aims	This module aims to provide the candidate with the knowledge and confidence to prepare, process, and stain osteoarticular and soft tissue histology tissue samples. Candidates will gain a clear understanding of the anatomy and physiology of osteoarticular an soft tissue, the pathological basis of disorders of osteoarticular and soft tissue, and how these may be investigated histologically. For the purposes of this module, osteoarticular and soft tissue includes: Bone Synovium Soft tissues This module does not encompass muscles, nerves, or bone marrow trephines which are covered in other specialist modules
Learning outcomes	1. Discuss how the anatomy and pathophysiology of osteoarticular and soft tissue systems interact. 2. Discuss how pathological processes including inflammation, neoplasia, and infection relate to osteoarticular and soft tissue. 3. Explain when and why samples of osteoarticular and soft tissue need to be prepared prior to dissection, as well as how this should be done. 4. Explain dissection/tissue selection protocols and block selection rationale for samples of osteoarticular and soft tissue, as relevant to your laboratory. 5. Describe how normal and abnormal osteoarticular and soft tissue stained using Haematoxylin and Eosin (H&E) should appear when viewed with a microscope, use examples relevant to your practice. 6. Explain when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities of osteoarticular and soft tissue; identify all the relevant stains and techniques. 7. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above – use examples relevant to your practice. 8. Demonstrate how you are involved in any part of the process between tissue preparation and reporting for an osteoarticular or soft tissue sample. 9. Discuss how cellular pathology investigations impacts the management of patients with osteoarticular and/or soft tissue disorders.
Indicative Content	Candidates require knowledge and understanding of: Tissue preparation techniques for samples of osteoarticular and soft tissue. Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for samples of bone and soft tissue.

	Quality control for basic (H&E) and advanced (IHC, special staining, companion diagnostics) stains that may be utilised for samples of osteoarticular and soft tissue. EQA schemes for staining techniques associated with osteoarticular and soft tissue. Tissue retention requirements related to samples of osteoarticular and soft tissue. The principles of tumour grading and staging with respect to osteoarticular and soft tissue samples. Invasive and non-invasive surgical procedures and their relationship to the collection of osteoarticular and soft tissue samples. Candidates must be able to use microscopes.

Module Title	Tissue Specific Pathways: Skin Histology
Module code	7698
Rationale/ Aims	This module aims to provide the candidate with the knowledge and confidence to prepare, process, and stain skin histology tissue samples. Candidates will gain a clear understanding of the anatomy and physiology of the skin, the pathological basis of disorders of the skin, and how these may be investigated histologically.
Learning outcomes	1. Discuss how the anatomy and pathophysiology of the skin interact. 2. Discuss how pathological processes including inflammation, neoplasia, and infection relate to skin tissue samples. 3. Explain when and why samples of the skin need to be prepared prior to dissection, as well as how this should be done. 4. Explain dissection/tissue selection protocols and block selection rationale for samples of the skin, as relevant to your laboratory. 5. Describe how normal and abnormal skin tissue stained using Haematoxylin and Eosin (H&E) should appear when viewed with a microscope, use examples relevant to your practice. 6. Explain when and why special stains, immunohistochemical (IHC), immunofluorescence (IF) markers and other specialist histology techniques might be required to demonstrate abnormalities of the skin; identify all the relevant stains and techniques. 7. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above – use examples relevant to your practice. 8. Demonstrate how you are involved in any part of the process between tissue preparation and reporting for a skin tissue sample. 9. Discuss how cellular pathology investigations impacts the management of patients with skin disorders.
Indicative Content	Candidates require knowledge and understanding of: Tissue preparation techniques for samples of the skin. Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for samples of the skin. Quality control for basic (H&E) and advanced (IHC, special staining, companion diagnostics) stains that may be utilised for samples of the skin. EQA schemes for staining techniques associated with the skin. Tissue retention requirements related to samples of the skin. The principles of tumour grading and staging with respect to skin tissue samples. Invasive and non-invasive surgical procedures and their relationship to the collection of skin tissue samples. Candidates must be able to use microscopes.

Module Title	Haematoxylin and Eosin (H&E)/Special Staining Technique Theory
Module code	7697
Rationale/ Aims	This module provides the candidate with clear insights into the fundamental principles and practices of H&E/specialist staining techniques, and their diagnostic value in routine cellular pathology Candidates will gain knowledge and understanding of H&E/specialist staining technique dyes and reagents and how these interact with intra and extra-cellular tissue elements. Candidates will gain knowledge of how these elements can be directly related to specific pathological conditions and disorders. Candidates will understand and be able to apply in practice how the quality of H&E/specialist staining techniques is maintained and how to identify, investigate, and resolve performance non-conformances Candidates will be able to review H&E and specialist technique-stained slides and recognise when tissue elements are appropriately, optimally demonstrated and when they fail to meet quality requirements.
Learning outcomes	1. Explain what is meant by the following dye chemistry terms (provide specific examples of dyes, reagents, or staining techniques wherever possible): dye azo dye auxochrome chromophore acid/basic/amphoteric dyes mordant dye-lake elective solubility sudanophilic lipochrome metachromatic dye haematoxylin haematein progressive/regressive staining alum and iron haematoxylins selective differentiation selective eosin staining 2. Describe the principles of H&E staining and the criteria that define optimal H&E staining, identify potential problems that can arise when performing H&E staining and explain how they can be avoided or resolved. 3. Describe staining techniques and staining mechanisms used for the demonstration of fibrin, elastin, collagen, and muscle, and explain the rationale for each of these techniques.

	4. Compare and contrast the difference between the argyrophil and argentaffin silver reactions. Identify the various staining techniques that utilise such reactions and the tissue elements they demonstrate and explain the rationale. 5. Identify the staining techniques for the demonstration of amyloid and explain the rationale. Identify the critical assessment step that definitively confirms the presence of amyloid. Identify potential problems that can arise when performing amyloid demonstration and explain how they can be avoided or resolved. 6. Discuss the staining techniques for the demonstration of glycogen and mucins, describe in detail how the reagents involved in the techniques produce differential demonstration of the target elements. Discuss when differentiating mucin types, why the order of the reagents used in a particular technique is vital to accurate diagnostic interpretation. 7. Describe how the staining reagents involved in Gram, Ziehl-Neelsen and Wade Fite produce differential demonstration of organisms and give examples of the organisms identifiable by these techniques. 8. Identify the staining techniques used to demonstrate haemosiderin, copper associated protein (CAP) and elemental copper and describe the rationale of the staining reactions. Discuss how misidentification of haemosiderin, copper associate protein (CAP) and elemental copper could occur. 9. Identify the quality governance that can be used to provide auditable documentary evidence that cellular pathology laboratories are continually monitoring and maintaining consistent, high-quality H&E/specialist staining. Describe the function of each governance process identified including validation. 10. Discuss with examples the process of selecting and validating high-quality positive control tissue used for special staining. Discuss issues around different options for sourcing and acquiring positive control tissue and the advantages and disadvantages of each option.
Indicative Content	Candidates will require knowledge and understanding of: **Stain Chemistry** Chromophore classifications and auxochromes Classification of dyes - structure and charge Dye-tissue bonding - charge mechanisms Mordants and dye-lakes Effect of pH, osmolarity, molecule size, temperature on staining Staining mechanisms - true dye, histochemical, metallic impregnation, and elective solubility **Haematoxylin and Eosin Staining** Principles of H&E staining and its diagnostic value Advantages and disadvantages of haematoxylin mordants Progressive and regressive staining

	Differentiation and blueing Eosin types, diluents, and staining selectivity **Special Staining Techniques** Principles, mechanisms and expected optimal staining expressions of special staining techniques employed to classify and demonstrate: Collagen, muscle, reticulin and elastic fibres Fibrin deposits Basement membranes Amyloid Glycogen and mucins Endogenous and exogenous pigments/minerals Lipids and myelin Micro-organisms, fungi, and parasites **Pathophysiology** Clinical conditions (metabolic, physiological, pathological, and genetic) that require the use of special staining techniques to demonstrate specific tissue elements/deposits important to achieving a clinical diagnosis **Positive Control Tissue** Characteristics of appropriate control tissue Sourcing and acquisition Pre-analytical factors affecting control performance Verification and validation Pre-cut section storage Use of same slide controls **Quality** Assessment of H&E/special staining and recognition of the expected optimal staining expressions IQC, IQA and EQA of H&E/special staining, the identification of staining artefacts and their resolution Quality monitoring procedures for stains, reagents, buffers, control tissue, equipment, and staining instruments involved in H&E/special staining

Module Title	Immunohistochemistry (IHC) Techniques
Module code	7699
Rationale/ Aims	This module provides the candidate with clear insights into the fundamental principles and practices of enzyme based advanced polymer immunohistochemical (IHC) and immunofluorescent (IF) techniques and their diagnostic value in routine cellular pathology This module will enable candidates to understand and describe the manner in which IHC/IF based demonstration techniques interact with protein biomarkers in cellular tissue and understand how the demonstration of these elements can be directly related to specific pathological conditions/disorders and therapies. Candidates will be able to review IHC/IF stained slides, identify and resolve technical issues and recognise appropriate, optimal biomarker demonstration. Candidates will understand how the quality of IHC/IF based demonstration techniques are maintained in cellular pathology by the implementation of process verification/validation procedures, continuous quality performance monitoring (IQC/IQA/EQA) and the identification, investigation, and resolution of performance non-conformances.
Learning outcomes	1. Explain what is meant by the following IHC/IF terminology endogenous enzyme blocking protein blocking monoclonal antibodies polyclonal antibodies epitope (antigen) retrieval reagents advanced polymer detection systems avidin-biotin detection system IHC detection systems enzymes IHC chromogens companion diagnostic IHC assay direct and indirect IF IF coloured labels tissue autofluorescence 2. Describe the principles and rationales involved in IHC including but not limited to; epitope retrieval blocking techniques slide selection advanced polymer detection system including their benefits and limitations over other IHC detection systems commonly used enzymes and chromogens including uses in diagnostic cellular pathology 3.Explain the criteria that define optimal IHC staining and discuss the merits of the manufacturing options available for antibodies and their use.

	4.Demonstrate the process by which the optimal dilution of an antibody is validated. Explain, with examples, why optimal antibody dilution is so important. Demonstrate the verification of antibodies in the lab and explain how this differs from validation. 5.Discuss the following: The main characteristics of high-quality positive control tissue and how the quality and suitability is confirmed prior to use Identification of possible options for sourcing and acquiring positive control tissue including the advantages and disadvantages of each option Problems with regulations and sourcing, biomarker content and "good" controls Different ways IHC control sections are used in clinical testing 6.Explain the factors that can affect antigen degradation during storage of pre-cut control sections and suggest ideal storage conditions. 7.Evaluate the difference between and in-vitro-diagnostic (IVD) IHC test and a non-IVD IHC test paying particular reference to ISO15189 and explain how this applies to practice where relevant. 8.Discuss possible ramifications of a failed IHC/IF QC check for the laboratory and the patient(s), consider tissue sample size, staining variation and complimentary staining patterns across different markers. 9.Explain the value of IF in diagnostic cellular pathology. Describe the principles and rationales involved in IF including the use and value of different fluorescent labels and the criteria that define optimal IF staining
Indicative Content	Candidates require knowledge and understanding of: How IHC protocols developed from its earliest format in the 1940s to the current automated advanced polymer systems used in cellular pathology The effect of pre-analytical damage on antigen preservation The link between epitope retrieval and optimal IHC staining The effect of microtomy induced damage on antigen demonstration Antibody structure and binding mechanisms Basic immunology Tissue structure and histological tissue recognition Fluorescence and use of fluorescent microscopes

	Principles, mechanisms and expected optimal staining expressions of IHC biomarkers Association between specific biomarkers and drug therapies Different approaches that could be employed to block non-specific elements in tissue sections, e.g., endogenous enzymes, endogenous biotin and electrostatic attraction **Pathophysiology** Clinical conditions (metabolic, physiological, pathological, and genetic) that require the use of IHC/IF techniques to demonstrate specific tissue biomarkers important to achieving a clinical diagnosis or potential drug therapies **Quality** Assessment of IHC/IF staining and recognition of the expected optimal staining expressions IQC, IQA and EQA of IHC/IF staining, the identification of staining artefacts and their resolution Quality monitoring procedures for antibodies, reagents, buffers, control tissue, equipment, and staining instruments involved in IHC/IF staining

Module Title	Companion Diagnostics
Module code	**7702**
Rationale/ Aims	This module provides the candidate with clear insights into the fundamental principles and practices of companion diagnostic techniques and their value in cellular pathology. This module will enable the candidate to describe and understand the range of companion diagnostic tests available in the determination of personalised treatment options for disease conditions in cellular pathology. Candidates will be able to review stained slides from companion diagnostic techniques, identify and resolve technical issues and recognise appropriate, optimal biomarker demonstration. Candidates will understand how the quality of companion diagnostic techniques are maintained in cellular pathology by the implementation of process verification/validation procedures, continuous quality performance monitoring (IQC/IQA/EQA) and the identification, investigation, and resolution of performance non-conformances.
Learning outcomes	1. Explain with examples what is meant by the following terminology (provide specific examples of functionality, composition, and usage wherever possible) • Companion diagnostics • Predictive markers • Prognostic markers 2. Discuss with examples, pathological conditions identified using companion diagnostic markers in cellular pathology and explain how the outcome of these investigations directs to specific drug therapies. 3. Describe with examples the principles of companion diagnostics and biomarker staining and the scoring criteria that define positive staining. 4. Describe with examples how outcomes of IHC dictates further testing. 5. Discuss potential problems that can arise when performing the stains and explain how they can be avoided or resolved. 6. Discuss with examples the process of selecting and validating high-quality positive control tissue used for companion diagnostic tests. 7. Discuss issues around options for sourcing and acquiring positive control tissue for companion testing and describe the advantages and disadvantages of each option. 8. Discuss the importance of Food and Drug Administration (FDA) approved (‘lock down’) protocols and the impact of deviating from these regulated procedures.

Indicative Content	Candidates will require knowledge and understanding of: Association between specific biomarkers and drug therapies such as HER2 in breast and gastric cancer. Biomarkers Oestrogen receptors, progesterone receptor, PD-1/PD-L1, Alk, Ros-1, BRAF V600E. Triple negative results for example in breast cancer. Use of semi-quantitative scoring Assessment of stained slides and recognition of the expected optimal staining expressions IQC, IQA and EQA of stained slides, the identification of staining artefacts and their resolution

Module Title	Molecular Pathology for Cellular Pathology
Module code	7701
Rationale/ Aims	This module enables the candidate to gain understanding of the sample requirements for molecular studies and how to facilitate handling and transport of tissue samples for subsequent molecular testing. Candidates will also gain knowledge of prioritisation of testing and dealing with potential sample contamination/carryover.
Learning outcomes	1. Describe which samples require fixation, which samples do not and explain why. 2. Discuss the importance and impact of fixation in molecular studies. 3. Describe the requirements for transport of specimens, which may require molecular investigations, to the laboratory and explain why these are important. 4. Evaluate the impact of cold ischaemic time on a sample and discuss steps that can be taken to reduce this. 5. Discuss prioritising molecular and non-diagnostic testing when there is limited sample, use relevant examples. 6. Explain the principles of tumour grading and staging with respect to tissue sampling and the principles of mirror-block sampling. 7. Discuss the rationale of tissue selection procedures for molecular testing and assess material for suitability in molecular testing. 8. Demonstrate appropriate handling of tissue for molecular testing. 9. Describe how sample contamination/carry over might be assessed and resolved within paraffin embedded samples.
Indicative Content	The candidate requires knowledge and understanding of: IBMS principles of good practice in histological dissection The chemistry of fixation using common fixatives Tumour stage and grade, implications of molecular testing on treatment Personalised / precision medicine RCPath tissue pathways

Module Title	Microscopy Techniques
Module code	7700
Rationale/ Aims	Candidate will understand how a light microscope works and will be able to set one up to optimal working conditions. The candidate will understand alternative forms of microscopy, how they work and differ from a light microscope and their use in diagnosis in cellular pathology. Candidate will be able to identify normal histology of major organ systems and key features of pathological processes.
Learning outcomes	1. Explain how a light microscope works and highlight key features of set-up and troubleshooting poor image quality. 2. Demonstrate setting up a microscope for Kohler illumination. 3. Describe and demonstrate basic maintenance of a light microscope. 4. Explain how the following forms of microscopy work: Polarising microscope Fluorescent microscope Electron Microscope 5. Describe where the following forms of microscopy can be used in diagnosis: Polarising microscope Fluorescent microscope Electron Microscope 6. Demonstrate, with examples, normal histology of major organ systems based on microscopic evaluation of tissue sections. 7. Demonstrate, with examples key features of pathological processes based on microscopic evaluation of tissue sections.
Indicative Content	Candidates require knowledge and understanding of: Histology of major organ systems and cells Histology of pathological processes Candidates need to be able to Troubleshoot issues in light microscopy practice.

Module Title	Digital Pathology and Artificial Intelligence
Module code	7703
Rationale/ Aims	Candidate will gain the knowledge and confidence to utilise digital pathology and artificial intelligence systems. Candidate will gain understanding of the principles and the technical and regulatory requirements relating to digital pathology and artificial intelligence. Candidate will understand the implications, benefits and limitations of digital pathology in practice.
Learning outcomes	1. Discuss the different types of digital pathology systems, explaining when and how they could best be utilised and how they can benefit the patient pathway. 2. Explain the principles of whole slide image scanning that facilitate the creation of high resolution digital virtual slides, including digital image capture and encoding, file formats, tiling, and z-stacking. 3. Discuss the theoretical basis of system integration/interfacing and why it is important in the context of digital pathology, consider messaging standards and data quality. 4. Discuss data storage considerations for a digital pathology system, giving consideration to data retention, data protection, and information governance requirements. 5. Discuss how common digital pathology systems should be operated and maintained, provide an example of troubleshooting if relevant to your laboratory/practice. 6. Explain when and why artificial intelligence applications might be used in your laboratory to enhance patient outcomes, provide an example of an application and discuss the benefits. 7. Discuss appropriate quality control steps that might be employed prior and post digital whole slide imaging; identify common quality issues and describe how these could adversely affect diagnostic accuracy in relation to the use of whole slide images and artificial intelligence applications. 8. Explain how digital pathology and artificial intelligence can benefit laboratory and professional practice in relation to training, staff wellbeing, and quality indicators. 9. Discuss the ethical, regulatory, and legal considerations relating to digital pathology and artificial intelligence.
Indicative Content	Candidate requires knowledge and understanding of: Computer and data science concepts. Laboratory automation/robotics. Theoretical basis of artificial intelligence. Messaging and imaging standards utilised in pathology. Data protection regulations and clinical risk management protocols.

	RCPath guidelines relating to digital pathology and artificial intelligence. ISO 15189 requirements for quality.

Optional Modules

Module Title	**Bone Marrow Trephine Biopsies**
Module code	7704
Rationale/ Aims	This module provides candidates with the knowledge, skills, and confidence to fix, process, embed, microtomy, stain, and quality control bone marrow trephine biopsies. This module enables candidates to gain knowledge and a clear understanding of the function, structure, and the cellular features of the bone marrow tissue, the clinical significance of bone marrow trephine biopsy, the sampling process, and how they are processed and investigated histologically.
Learning outcomes	1. Explain the normal function, structure, and cellular features of the bone marrow tissue. 2. Discuss the clinical significance of bone marrow examination and the bone marrow trephine sampling process. 3. Discuss how the bone marrow trephine sampling and laboratory processes may affect the subsequent quality of laboratory investigations. 4. Discuss how bone composition in bone marrow trephine biopsies influences choice of decalcification methods. 5. Demonstrate with examples the fixation, decalcification (if relevant to practice), processing, embedding, and the microtomy of bone marrow trephine biopsies for light microscopy. 6. Demonstrate with examples the analysis of the bone marrow trephine biopsy stained with Haematoxylin and Eosin (H&E), discuss cell populations and patterns observed. 7. Demonstrate with examples the analysis of the bone marrow trephine biopsy stained with special stains, discuss cell populations and staining patterns observed. 8. Discuss when and why immunohistochemical (IHC) markers would be used for bone marrow trephine biopsies and using diagnostic examples explain the staining patterns obtained.
Indicative Content	Candidates require knowledge and understanding of: Bone marrow function. Bone and bone marrow histology. Tissue preparation techniques for bone marrow trephine biopsies. Basic H&E and advanced (special stains and IHC) staining theory for stains that may be utilised for bone marrow trephine biopsies. EQA schemes for staining techniques for bone marrow trephine biopsies.

Module Title	Central Nervous System
Module code	7705
Rationale/ Aims	This module provides the student with the knowledge and confidence to process, stain, and quality control central nervous system histology tissue samples, namely brain, skull base, spinal and pituitary samples. Candidates will gain knowledge and understanding of the pathological basis of disorders of the central nervous system, and how these may be investigated histologically. Candidates will understand when and why samples are prepared prior to investigation and the rationale behind tissue and block selection. Candidates will gain knowledge of the variety of stains used when investigating disorders of the CNS and be able to identify normal and abnormal tissue. Candidates will understand the role of histopathology in the diagnosis of central nervous system disease and patient treatment and management and the laboratory quality systems in place to maintain patient safety.
Learning outcomes	1. Describe commonly seen pathological conditions of the central nervous system (CNS) investigated by a cellular pathology laboratory. *2.* Discuss the rationale behind the specific sample requirements for CNS samples in cellular pathology. *3.* Explain dissection/tissue selection protocols and block selection rationale for samples from the central nervous system. 4. Describe how normal and abnormal tissue from the central nervous system that has been stained using Haematoxylin and Eosin (H&E) should appear when viewed with a microscope. *5.* Discuss when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities in the central nervous system. *6.* Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above, use examples relevant to your practice. 7. Demonstrate processing specimens from the central nervous system and discuss how this differs from processing other cellular pathology specimens. *8.* Discuss how cellular pathology investigations impacts the management of patients with CNS disease.
Indicative Content	Candidates should have knowledge of: Anatomy and pathophysiology of the central nervous system. Tissue preparation techniques for samples from the central nervous system. Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for samples from the central nervous system. Quality control for basic (H&E) and advanced (IHC, special staining, companion diagnostics) stains that may be utilised for samples from the central nervous system. Quality systems for staining techniques associated with the central nervous system.

	Tissue retention requirements related to samples from the central nervous system. The role of cellular pathology in supporting the diagnosis and treatment of central nervous system patients

Module Title	Electron Microscopy
Module code	7706
Rationale/ Aims	Candidates will understand how transmission electron microscopy contributes to diagnosis and the specific technical requirements necessary for tissues to be prepared for electron microscopy. Candidates will be able to identify ultrastructural features in commonly examined tissues.
Learning outcomes	1. Discuss how clinical information, diagnostic tests and light microscopy such as special stains and immunofluorescent/ Immunohistochemical techniques inform the Electron Microscopy assessment. 2. Explain the effect of different fixation regimes on ultrastructure and discuss the impact of this to diagnosis. 3. Demonstrate with examples processing and embedding of tissues for electron microscopy and explain the health and safety considerations of reagents used. 4. Demonstrate with examples, sectioning and contrasting techniques for electron microscopy. 5. Discuss how an electron microscope is operated and how this influences the production of quality images. 6. Discuss the requirements of storage and handling of digital images with regards to information governance in electron microscopy. 7. Demonstrate with examples the normal ultrastructure of common tissues examined in an electron microscope. 8. Demonstrate with examples ultrastructural features that can be seen in pathologies of commonly examined tissues. 9. Compare and contrast how scanning electron microscopy differs from transmission electron microscopy.
Indicative Content	Candidates require knowledge and understanding of: Normal histology and ultrastructure of tissues examined in your EM Unit. Basic ultrastructure of pathologies seen in tissues examined in your EM Unit

Module Title	Specialist Techniques: Mohs
Module code	7707
Rationale/ Aims	This module will provide the student with the knowledge and confidence to process, stain, and quality control Mohs histology tissue samples. Completion of this module will enable the student to gain a clear understanding of the principles and practice of Mohs histological procedures. In addition, there will be an improved understanding of the key tumour types commonly seen in Mohs, and how these may be investigated histologically.
Learning outcomes	1. Explain the principles of Mohs histological procedures. 2. Compare and contrast the key benefits of Mohs histological procedures over alternative surgical and histological procedures. 3. Discuss basic pathological tumour entities commonly seen within Mohs histological assessments. 4. Explain the key technically complex aspects of processing and embedding Mohs tissues to ensure optimal complete circumferential and deep tissue margin clearance. 5. Explain dissection inking and anatomical map protocols for Mohs investigations. 6. Discuss the differences between normal uninvolved skin and abnormal tumour involved tissue from Mohs cases stained using both Haematoxylin and Eosin (H&E) and Toluidine Blue stains. Explain how the H&E and Toluidine Blue staining works. 7. Explain when and why immunohistochemical (IHC) markers might be required to demonstrate abnormalities in Mohs cases. 8. List the IHC markers that are associated with the differing tumour types that may be required to identify abnormalities in Mohs cases and explain the rationale for why they should be used. Demonstrate an example from practice. 9. Demonstrate with examples common quality control issues that might be encountered with routine H&E, Toluidine Blue and IHC (if relevant to practice) staining techniques and explain how each of these issues might be resolved.
Indicative Content	Candidates require knowledge and understanding of: Tissue preparation and embedding techniques for samples from Mohs cases Basic (H&E) and advanced (IHC) staining theory for stains that may be utilised for samples from Mohs cases. Tissue retention requirements related to samples from Mohs cases. EQA schemes for staining techniques associated with the Mohs tissues.

Module Title	Muscle and Nerve Biopsies
Module code	7709
Rationale/ Aims	This module enables candidates to understand how muscle and nerve tissues are handled to produce a diagnostic result. Candidates will gain knowledge and understanding of preservation/fixation, orientation, relevant histological techniques and how these are used to achieve a diagnosis. Candidates will be able to prepare samples for analysis, identify structural, histochemical and cellular elements within biopsies and apply quality assurance principles in practice.
Learning outcomes	1. Explain the principles of both muscle and nerve biopsy and the clinical application of demonstration techniques used in the diagnosis of muscle and nerve disease. 2. Demonstrate with examples how to prepare fresh muscle biopsy tissue for frozen, fixed and electron microscopy analysis. 3. Demonstrate with examples how to prepare fresh nerve tissue for direct visualisation, routine staining, histochemical and impregnation methods for nerve tissue. 4. Discuss the rationale behind demonstration techniques used on muscle and nerve biopsies. 5. Identify using examples from your practice structural, histochemical and cellular elements within skeletal muscle biopsies. 6. Identify using examples from your practice structural, histochemical and cellular elements within nerve biopsies. 7. Demonstrate with examples the selection and use of appropriate control material. 8. Discuss how stained sections are assessed for quality and how any quality issues are resolved including root cause analysis. 9. Discuss the risks and hazards associated with muscle biopsy and nerve biopsy and reagents used in diagnostic techniques and how these are controlled.
Indicative Content	Candidates require knowledge and understanding of: Normal histology of skeletal muscle and how skeletal muscle differs from smooth muscle and cardiac muscle. Normal histology of nerves Basic pathologies of muscle and nerve tissues

Module Title	Ophthalmic Biopsies
Module code	7708
Rationale/ Aims	This module aims to provide the candidate with the knowledge and confidence to prepare, process, and stain ophthalmic biopsy tissue samples. Candidates will gain a clear understanding of the anatomy and physiology of the eye and orbit relevant to ophthalmic biopsies, the pathological basis of disorders of ophthalmic biopsies, and how these may be investigated histologically.
Learning outcomes	1. Discuss how the anatomy and pathophysiology of the eye and orbit interact relevant to ophthalmic biopsies. 2. Discuss how pathological processes including inflammation, neoplasia (including lymphoma), and infection relate to ophthalmic biopsies. 3. Demonstrate, with examples from candidates practice, receipt and triage of ophthalmic samples and discuss the importance of appropriate triage. 4. Demonstrate identification of macroscopic detail and application of clinical information to make decisions on further steps required. Discuss steps taken, e.g. referral and describe processes involved. 5. Explain dissection/tissue selection protocols and block selection rationale for ophthalmic biopsies, as relevant to your laboratory. 6. Describe how normal and abnormal ophthalmic biopsies stained using Haematoxylin and Eosin (H&E) should appear when viewed with a microscope, use examples relevant to your practice. 7. Explain when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities of ophthalmic biopsies; identify all the relevant stains and techniques. 8. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above – use examples relevant to your practice.
Indicative Content	Candidates require knowledge of: Tissue preparation techniques for ophthalmic biopsies. Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for ophthalmic biopsies. Quality control for basic (H&E) and advanced (IHC, special staining,

	companion diagnostics) stains that may be utilised for ophthalmic biopsies. EQA schemes for staining techniques associated with ophthalmic biopsies. Tissue retention requirements related to ophthalmic biopsies. The principles of tumour grading and staging with respect to ophthalmic biopsies. Invasive and non-invasive surgical procedures and their relationship to the collection of ophthalmic biopsies. Candidates must be able to use microscopes.

Module Title	Rectal Biopsies for Suspected Hirschsprung's Disease
Module code	7710
Rationale/ Aims	This module provides candidates with the knowledge and confidence to process, stain, and quality control rectal biopsies for suspected Hirschsprung's disease. Candidates will gain a clear understanding of the anatomy and physiology of the embryology of the colon and rectum, the pathological basis of Hirschsprung's disease, and how these may be investigated histologically.
Learning outcomes	1. Explain the embryology, anatomy and pathophysiology of the GI tract. 2. Discuss pathological processes in relation to the colon, rectum and Hirschsprung's disease. 3. Explain when and why samples from suspected Hirschsprung's disease patients are prepared prior to dissection. 4. Explain dissection/tissue selection protocols and discuss block selection rationale for samples with suspected Hirschsprung's disease. 5. Compare the microscopic appearance of normal tissue and tissue from Hirschsprung's disease that has been stained using Haematoxylin and Eosin (H&E). 6. Discuss when and why special stains, immunohistochemical (IHC) markers and other specialist histology techniques might be required to demonstrate abnormalities associated with Hirschsprung's disease. 7. Identify the IHC, special stain, and other specialist staining techniques associated with identifying abnormalities associated with Hirschsprung's disease and explain the staining theory relating to each technique. 8. Describe the staining patterns you would expect to be able to view microscopically for each of the IHC, special, and other staining techniques listed above. 9. Demonstrate the different techniques used in the investigation of suspected Hirschsprung's Disease.
Indicative Content	Candidates require knowledge and understanding of: Tissue preparation techniques for samples from suspected Hirschsprung's disease samples. Basic (H&E) and advanced (IHC, special staining, companion diagnostics) staining theory for stains that may be utilised for samples for suspected Hirschsprung's disease. Quality control for basic (H&E) and advanced (IHC, special staining, companion diagnostics) stains that may be utilised for samples for suspected Hirschsprung's disease. EQA schemes for staining techniques for suspected Hirschsprung's

	disease. Tissue retention requirements related to samples from the GI tract.

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