AUSTRALIAN INSTITUTE OF
MEDICAL AND CLINICAL SCIENTISTS

# Fellowship Discipline

# Modules Anatomical

# Pathology

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First Published: 2025
Effective from October 2025

# Introduction

**THE DISCIPLINE MODULES HANDBOOK IS TO BE READ IN CONJUNCTION WITH THE AIMS FELLOWSHIP BOOKLET: PROCEDURES AND REGULATIONS.**

The AIMS Fellowship is divided into four stages, all of which must be successfully completed.

This booklet contains the four discipline-based modules that comprise Stage 1 (Modules 1 and 2) and Stage 2 (Modules 3 and 4).

Stage 1 (Modules 1 and 2) must be successfully completed before enrolling into Stage 2 (Modules 3 and 4).

Each module documents the aims, learning outcomes, syllabus and provides some learning resources for the topic/s covered. Modules are assessed by written examination conducted in-person or online. Examinations are held twice a year as required in June (applications close at the end of February) and November (applications close at the end of July). Candidates must apply to sit the examinations using the Fellowship Examination Application Form and pay the relevant fee.

Note: A member with less than two (2) years continuous Professional Membership, but with more than five (5) years postgraduate experience (within the previous 10 years), may complete Stage 1 (Modules 1 and 2) prior to enrolling and be granted advanced standing (ie credit) for successfully completed modules when eligible to enrol in the full Fellowship program.

All modules are compulsory.

# Anatomical Pathology I

| Module | HISTOLOGICAL TECHNIQUES AND STAINING THEORY |
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| **Assumed knowledge** | Histological structure, development and function of normal tissue types as demonstrated in routine and special staining procedures |
| **Aim** | To develop and apply expert knowledge, investigative practice and clinical skills relevant to the routine Anatomical Pathology laboratory. |
| **Module learning outcomes (MLO)** | On completion of this module the candidate will be able to:<br>(i) Discuss the microscope: principles, limitations and roles<br>(ii) Describe the procedures required to receive, identify and manage specimens<br>(iii) Explain the principles, procedures and technology used in routine and alternative techniques of tissue fixation, processing and embedment<br>(iv) Discuss the technical principles and performance of histological techniques including limitations, problem detection and successful troubleshooting<br>(v) Discuss and evaluate automation used in the Anatomical Pathology laboratory<br>(vi) Interpret, evaluate and explain technical faults that may occur and their impact on the clinical interpretation of results<br>(vii) Discuss the concept of standardisation pertaining to pre-analytic, analytic and post-analytic histological processes |

| Theme | Syllabus |
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| **Microscopy: principles, techniques and applications**<br>**MLO (i)** | • Optical transmitted light (brightfield) microscope<br>• Reflected fluorescence microscope<br>• Polarized light microscope<br>• Phase contrast microscope<br>• Confocal microscope |
| **Specimen management**<br>**MLO (ii)** | • Specimen identification and tracking by manual, digitization and electronic processes<br>• Aligning clinical information with relevant tissue preparation and histological identification methods<br>• Reporting templates<br>• Tissue and slide retention protocols<br>• Standardisation pertaining to pre-analytic, analytic and post-analytic histological processes |
| **Specimen preparation**<br>**MLO (iii), (v)** | • Chemistry and mode of action of agents used in tissue fixation and processing<br>• Strategies for optimal fixation<br>• Microwave radiation in fixation and processing<br>• Alternative technologies available for tissue processing<br>• Microtomy and section preparation<br>• Fresh tissue with particular reference to nerve, muscle and renal biopsies<br>• Cryotechniques and frozen section preparation<br>• Pre-treatments for bone and other calcified tissue<br>• Sharing of tissue for non-histological assays |

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| **Staining theory, histochemistry, rationale, performance and clinical applications MLO (iv), (v), (vii)** | *Standard identification techniques*<br>• Haematoxylin – all forms in use<br>• Eosin and alternative counterstains<br><br>*Special stain/histochemical techniques to demonstrate:*<br>• Mucins, glycogen and proteoglycans<br>• Connective and mesenchymal tissues<br>• Muscle<br>• Neural tissue<br>• Iron, melanin, bile, lipofuscin pigments<br>• Microorganisms and viral inclusion bodies<br>• Amyloid<br>• Uric acid crystals |
| **Troubleshooting MLO (vi)** | • The impact of specimen collection, grossing and pre-analytical variables on tissue morphology<br>• Fixation and processing artefacts: causes and correction<br>• Embedding and microtomy faults: causes and correction<br>• Staining faults: causes and correction |

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| **Assessment** | Assessment in this module consists of a three-hour written examination.<br><br>The exam has two parts:<br>• Part A has two essay questions, which should be answered in a separate answer book. Each question is worth 35 marks (70 marks in total).<br>• Part B has 20 limited answer questions, all of which should be answered in the answer book provided. Each question is worth 5 marks (total 100 marks). |

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| **Learning resources** | *Reference books - the current editions of:*<br>Carson FL. *Histotechnology: A Self-Instructional Text*. ASCP Press<br>Cook DJ, Warren PJ. *Cellular Pathology: An Introduction to Techniques and Applications*. Scion<br>Horobin RW, Kiernan JA, (eds). *Conn's Biological Stains: A Handbook of Dyes, Stains and Fluorochromes for use in Biology and Medicine*. Taylor & Francis<br>Kerr JB. *Functional Histology*. Mosby<br>Kiernan JA. *Histological and Histochemical Methods: Theory and Practice*. Scion<br>Pawlina W. *Histology: A Text and Atlas with Correlated Cell and Molecular Biology*. Wolters Kluwer<br>Suvarna SK, Layton C, Bancroft JD. *Bancroft's Theory and Practice of Histological Techniques*. Elsevier<br>Woods AE, Ellis RC. *Laboratory Histopathology – A Complete Reference*. Churchill Livingstone |

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| | *Journals*<br>American Journal of Pathology<br>Archives of Pathology<br>Biotechnic and Histochemistry<br>European Journal of Histochemistry<br>Histopathology<br>Journal of Histochemistry and Cytochemistry<br>Journal of Histotechnology<br>Journal of Pathology<br><br>*Web-based resources*<br>StainsFile<br>https://stainsfile.info/xindex.html<br>WebPath<br>https://webpath.med.utah.edu/ |

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| **Version number** | *1.0* |
| **Date** | *November, 2025* |
| **Review date** | *September, 2028* |

# Anatomical Pathology II

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| **Module** | **SURGICAL CUT-UP**<br>**IMMUNOHISTOCHEMISTRY: PRINCIPLES AND PRACTICES**<br>**PATHOLOGICAL PROCESSES IN COMMON NEOPLASTIC AND NON-NEOPLASTIC CONDITIONS** |
| **Assumed knowledge** | Surgical pathology and anatomical terms<br>Immunology: principles and practices<br>Flow cytometry, ELISA procedures<br>Mortuary practice; legal regulations; postmortem procedures and tissue sampling; reporting and mortuary management |
| **Aims** | To develop and apply specialist knowledge, investigative practice and clinical skills relevant to:<br>a) the Cut-up ('grossing') of tissues and organs in Anatomical Pathology<br>b) immunohistochemistry (IHC) and its role in diagnostic Anatomical Pathology<br>c) the pathophysiology of disease states with particular emphasis on neoplastic conditions. |
| **Module learning outcomes (MLO)** | On completion of this module the candidate will be able to:<br>(i) Interpret and demonstrate the macroscopic cut-up of tissues and organs<br>(ii) Explain the theory, principles and application of IHC techniques to the identification of abnormalities in protein expression<br>(iii) Discriminate between the different automation technologies available for IHC assays<br>(iv) Analyse, interpret and report the outcomes of IHC techniques and relate to the clinical conditions under investigation<br>(v) Evaluate the role of internal and external Quality Control (QC) and Quality Assurance (QA) as applied to IHC techniques<br>(vi) Describe the pathological processes and histological changes occurring in common neoplastic and non-neoplastic conditions and correlate with clinical characteristics |

| **Theme** | **Syllabus** |
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| **Surgical cut-up**<br>**MLO (i)** | • Performance of the anatomical pathology cut-up according to NPAAC Requirements<br>• Processes involved in the recording, selection, dissection, sampling and describing of tissue for histological analysis<br>• The importance of surgical margins and the various methods used to track specimen orientation |
| **Immunohistochemistry**<br>**MLO (ii), (iii), (iv), (v)** | *Practical and theoretical principles*<br>• Immunorecognition and immunodetection of tissue components<br>• Performing IHC on formalin-fixed, paraffin-embedded (FFPE) tissue<br>• Immunofluorescence on fresh frozen tissue<br>• Multiplex staining<br>• Pre-analytic, analytic and post-analytic factors for IHC<br>• Antibody clones<br>• Various detection systems available |

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| | *Quality assurance (QA) and quality control (QC)*<br>• Validation and verification of IHC assays<br>• Use of appropriate controls for IHC<br>• Interpretation and reporting of IHC assays<br><br>*Applications*<br>• IHC in diagnostic anatomical pathology<br>• IHC in research settings<br><br>*Troubleshooting and refinement of the IHC assay* |
| **Pathological processes and disease states MLO (vi)** | • Morphological and functional alterations in cells and tissues due to injury, vascular insufficiency, infection, age-related changes, genetic disorders<br>• Neoplastic disease and the accompanying histological investigations<br>• Pathophysiology of common non-neoplastic diseases that occur in organs or organ systems<br>• Clinical characteristics and histological features of common conditions used to assist with diagnostic identification |

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| **Assessment** | Assessment in this module consists of a three-hour written examination.<br><br>The exam has two parts:<br>• Part A has two essay questions, which should be answered in a separate answer book. Each question is worth 35 marks (70 marks in total).<br>• Part B has 20 limited answer questions, all of which should be answered in the answer book provided. Each question is worth 5 marks (total 100 marks). |

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| **Learning resources** | *Reference books - the current editions of:*<br>Dabbs DJ, ed. *Diagnostic Immunohistochemistry: Theranostic and Genomic Applications.* Elsevier<br>Goldblum JR, Lamps LW, McKenney J, Myers JL. *Rosai and Ackerman's Surgical Pathology*. Elsevier<br>Kumar V, Abbas AK, Aster JC. *Robbins and Cotran: Pathologic Basis of Disease*. Elsevier<br>Lester SC. *Manual of Surgical Pathology*. Elsevier<br>Lin F, Prichard J. *Handbook of Practical Immunohistochemistry: Frequently Asked Questions*. Springer<br>National Pathology Accreditation Advisory Council (NPAAC). *Requirements for the Performance of Anatomical Pathology Cut-Up*. Commonwealth of Australia 2013<br>Nguyen T, ed. *Immunohistochemistry: A Technical Guide to Current Practices*. Cambridge University Press<br>Westra WH, Hruban RH, Phelps TH, Isacson C. *Surgical Pathology Dissection: An Illustrated Guide*. Springer<br><br>*Journals*<br>Applied Immunohistochemistry and Molecular morphology<br>Archives of Pathology |

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| | *Web-based resources*<br>NordiQC<br>https://www.nordiqc.org/<br>Pathology Outlines<br>https://pathologyoutlines.com<br>RCPA Cut-Up Manual<br>https://www.rcpa.edu.au/Manuals/Macroscopic-Cut-Up-Manual<br>WebPath® educational resource<br>https://webpath.med.utah.edu/webpath.html#MENU |

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# Anatomical Pathology III

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| **Module** | **MOLECULAR GENOMICS**<br>**ELECTRON MICROSCOPY** |
| **Assumed knowledge** | Fundamental principles and techniques applied in molecular genetics<br>Principles and use of scanning electron microscopy including X-ray analytics |
| **Aims** | To develop and apply specialist knowledge, investigative practice and clinical skills relevant to:<br>a) molecular genomics with particular reference to cancer diagnostics<br>b) transmission electron microscopy. |
| **Module learning outcomes (MLO)** | On completion of this module the candidate will be able to:<br>(i) Explain the theory and principles molecular techniques and applications in histological investigations<br>(ii) Discuss and evaluate the forms and applications of in-situ hybridisation assays available<br>(iii) Discern between the different technologies for the identification of somatic mutations including their advantages and limitations<br>(iv) Describe the pathological processes of common mutations resulting in disease states<br>(v) Discuss the role of mutation diagnostics in the clinical setting<br>(vi) Explain the technical processes required for preparing samples for transmission electron microscopy<br>(vii) Discuss the ultrastructural features of diseases typically diagnosed by transmission electron microscopy<br>(viii) Describe and evaluate the processes used to ensure results are accurate and reliable |

| **Theme** | **Syllabus** |
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| **Molecular techniques MLO (i), (ii), (iii), (iv), (v), (viii)** | *Testing for and identification of mutations in genes*<br>• PCR technique: principles, applications and variations<br>• Real-time PCR<br>• Sequencing techniques (Sanger, WGS, WES)<br><br>*Principles and practical applications in diagnostic anatomical pathology*<br>• DNA and RNA probes<br>• Pre-analytic, analytic and post-analytic factors<br>• In-situ hybridization (ISH) assays on FFPE tissue<br><br>*Quality assurance (QA) and quality control (QC)*<br>• Validation and verification of molecular assays<br>• Use of appropriate controls<br>• Interpretation and reporting of molecular assays<br><br>*Clinical correlations in molecular pathology*<br><br>*Limitations, troubleshooting and refinement of molecular assays* |

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| **Transmission electron microscopy (TEM) (vi), (vii), (viii)** | *Standard laboratory techniques*<br>• Fixation, processing and embedding tissue<br>• Ultramicrotomy, staining and recording of images<br>• Artefacts<br><br>*Clinical correlations in TEM*<br>• Role of TEM in tissue diagnostics<br>• Common non-neoplastic conditions and the associated changes at the electron microscope level<br>• Neoplastic disease and the accompanying electron microscopy investigations<br><br>*Limitations, troubleshooting and automation in TEM* |

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| **Assessment** | Assessment in this module consists of a three-hour written examination.<br><br>The exam has two parts:<br>• Part A has two essay questions, which should be answered in a separate answer book. Each question is worth 35 marks (70 marks in total).<br>• Part B has 20 short answer questions, all of which should be answered in the answer book provided. Each question is worth 5 marks (total 100 marks). |

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| **Learning resources** | *Reference books - the current editions of:*<br>Coleman WB, Tsongalis GJ, eds. *Diagnostic Molecular Pathology: A Guide to Applied Molecular Testing*. Academic Press<br>Dickersin GR. *Diagnostic Electron Microscopy: A Text/Atlas*. Springer<br>Ghadially FN. *Diagnostic Electron Microscopy of Tumours*. Butterworths<br>Hunter E. Practical *Electron Microscopy: A Beginner's Illustrated Guide*. Cambridge University Press<br>Leonard DBG. *Molecular Pathology in Clinical Practice*. Springer<br>Papadimitriou JM, Henderson DW, Spagnolo DV. *Diagnostic Ultrastructure of Non-Neoplastic Diseases*. Churchill Livingstone.<br>Stirling J, Curry A, Eyden B. *Diagnostic Electron Microscopy: A Practical Guide to Interpretation and Technique*. Wiley<br>Strachan T, Goodship J, Chinnery P. *Genetics and Genomics in Medicine*. Garland Science, Taylor & Francis<br>Strachan T, Read A. *Human Molecular Genetics*. Taylor & Francis<br>Vasef MA, Auerbach A. *Diagnostic Pathology: Molecular Oncology*. Elsevier<br><br>*Journals*<br>Advances in Molecular Pathology<br>Applied Immunohistochemistry and Molecular Morphology<br>EMBO Journal (Molecular Genetics/ Molecular Biology)<br>Journal of Clinical Pathology<br>Journal of Molecular Pathology<br>Seminars in Diagnostic Pathology<br>Ultrastructural Pathology |

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| | *Web-based resources*<br>American College of Medical Genetics Standards and Guidelines for Clinical Genetics Laboratories<br>https://www.nature.com/gim/articles?type=acmg-standards-and-guidelines<br>OMIMan: An Online Catalog of Human Genes and Genetic Disorders<br>https://www.omim.org<br>HUGO Gene Nomenclature Committee<br>https://genenames.org<br>Royal College of Pathologists of Australasia: Genetic tests and Laboratories<br>https://rcpa.edu.au/manuals/RGTL<br>Future Learn: The Genomics Era: the Future of Genetics in Medicine<br>https://www.futurelearn.com/courses/the-genomics-era |

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# Anatomical Pathology IV

| Module | **ADVANCED PRACTICE**<br>**LEADERSHIP, MANAGEMENT AND SUPERVISION** |
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| **Aims** | To explore innovative technologies and to describe the knowledge and attributes required for leadership as a clinical scientist and Anatomical Pathology laboratory manager. |
| **Module learning outcomes (MLO)** | On completion of this module the candidate will be able to:<br>(i) Describe and appraise the roles of digital imaging, image analysis and electronic reporting in clinical practice<br>(ii) Critically evaluate relevant research to predict and prepare for emerging laboratory practices and directional shifts<br>(iii) Discuss the components and requirements of a quality management system with reference to the role of internal and external Quality Control (QC) and Quality Assurance (QA)<br>(iv) Discuss the models in use and provision of pathology services in Australia<br>(v) Describe the principles of pathology laboratory accreditation and the procedures necessary to gain and maintain accreditation<br>(vi) Formulate and evaluate operational requirements in the Anatomical Pathology laboratory including occupational health and safety, standard operating procedures, laboratory information systems and all records and databases<br>(vii) Specify the attributes necessary for a leadership and supervisory role as a clinical scientist and laboratory manager |

| Theme | Syllabus |
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| **Evidence-based practice in Anatomical Pathology MLO (i), (ii)** | • Principles, processes and diagnostic value of digital imaging, image analysis and electronic reporting<br>• Applying research principles to ensure diagnostics are fit for purpose and to address and resolve issues in practice<br>• The Evidence-Based Practice (EBP) process<br>• Establishment and validation of new methods<br>• Applications and limitations of statistical analyses used in the clinical laboratory<br>• Anticipating, evaluating and responding to strategic direction shifts |
| **Quality management MLO (iii)** | • Quality management components of ISO15189 in pathology laboratories<br>• Quality control, quality assurance and quality management<br>• Standardisation<br>• Quality audit processes |
| **Pathology in Australia MLO (iv)** | • The organisation and delivery pf pathology services<br>• The public pathology model<br>• The private pathology model<br>• Definitions and operational roles of personnel in the laboratory workforce<br>• The oversight hierarchy for Laboratory Medicine<br>• The function and responsibilities of NPAAC<br>• The function and responsibilities of NATA<br>• State and Federal responsibilities<br>• Medicare funding of pathology |

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| **Practice and accreditation standards MLO (v)** | • Australian Standards for operation of pathology laboratories<br>• ISO15189 structure, components, requirements<br>• The accreditation process<br>• NATA accreditation requirements and processes<br>• Application of ISO15189 by NATA<br>• Non-conformance<br>• The role and impact of TGA and IVD issues for the Anatomical Pathology laboratory |
| **Laboratory operations MLO (vi)** | *Functional requirements*<br>• Ethical practice in collection, usage, storage and reporting confidential information<br>• Occupational Health and Safety (OHS) obligations of employers and employees<br>• Legislation and codes of practice<br>• Hierarchy of responsible persons<br>• Promotion of safe working practices<br>• Specific operational requirements in the Anatomical Pathology laboratory<br>• MSDS and Standard Operational Procedures (SOP)<br>• Processes and requirements for workplace inspections<br><br>*Risk assessment and risk management*<br>• Implementing safety controls to minimize risk<br>• Waste management and waste reduction, solvent and reagent recycling<br>• Identification and management of chemical, biological, genetic and equipment hazards, environmental issues<br>• Green laboratories – ISO standards<br>• Federal and state waste protocols |
| **Leadership and supervision in the Anatomical Pathology laboratory MLO (vii)** | *Principles of Leadership*<br>• Team dynamics, development and motivation in the laboratory setting<br>• Education and training for co-workers, support personnel, students<br>• Engagement with Continuing Professional Development (CPD) for self and workforce<br>• Involvement with professional societies, activities, conferences and symposia<br><br>*Managing people*<br>• Communication strategies, facilitating group dynamics, conflict resolution, workplace harassment and bullying<br>• Identifying and resolving errors<br>• Performance Management Techniques<br>• 'Managing change' processes<br>• Human resource management: Recruiting, Hiring, Evaluating<br>• Equal Employment Opportunity (EEO) Legislation and obligations<br><br>*Managing resources*<br>• Financial probity<br>• Time Management Skills<br>• Lean management principles in pathology |

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| **Assessment** | Assessment in this module consists of a three-hour written examination.<br><br>The exam has two parts:<br>• Part A has two essay questions, which should be answered in a separate answer book. Each question is worth 35 marks (70 marks in total).<br>• Part B has 20 short answer questions, all of which should be answered in the answer book provided. Each question is worth 5 marks (total 100 marks). |

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| **Learning resources** | *Reference books – the current edition of:*<br>Cohen S, ed. *Artificial Intelligence and Deep Learning in Pathology*. Elsevier<br>Garcia LS, Allen TC, Baselski VS, Church DL, Karcher DS, Lewis MR, Linscott AJ, Poulter MD, Procop GW, Weissfeld AS, Wolk DM. *Clinical Laboratory Management*. Wiley<br>McPherson RA, Pincus MR. *Henry's Clinical Diagnosis and Management By Laboratory Methods*. Elsevier Health Sciences<br><br>*Journals*<br>American Journal of Clinical Pathology<br>Australian Journal of Medical Science<br>British Medical Journal<br>Clinical Laboratory Medicine<br>New Zealand Journal of Medical Laboratory Science<br><br>*Web-based resources*<br>Public Pathology Australia<br>https://publicpathology.org.au/<br>Digital Pathology Association<br>https://digitalpathologyassociation.org<br>Australian Pathology<br>https://www.australianpathology.com/<br>MBS Schedule Category 6 – Pathology<br>NATA<br>https://www.nata.com.au/<br>National Pathology Accreditation Advisory Council (NPAAC)<br>https://www1.health.gov.au/internet/main/publishing.nsf/Content/health-npaac-index.htm<br>Pathology Funding Agreement (2012)<br>TGA and IVD<br>http://www.tga.gov.au/industry/ivd-regulatory-requirements.htm<br>WorkSafe Australia<br>https://www.safeworkaustralia.gov.au/ |

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