AUSTRALIAN INSTITUTE OF
MEDICAL AND CLINICAL SCIENTISTS

Fellowship Discipline Modules

Haematology

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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.

Haematology I

Module	CELLULAR AND DIAGNOSTIC HAEMATOLOGY
Assumed knowledge	Normal and abnormal cell physiology, clinical aspects relevant to routine haematological testing and other technical procedures related to cellular haematology.
Aim	To develop and apply expert knowledge, investigative practice and clinical skills relevant to the routine Haematology laboratory.
Module learning outcomes (MLO)	On completion of this module the candidate will be able to: (i) Describe haemopoiesis in detail including the factors which induce and regulate this process (ii) Discuss the pre-analytical factors that may impact the quality of the sample and the test results (iii) Explain the techniques and technology used in cellular investigations and related procedures performed in the routine Haematology laboratory including the principle of each technique, the performance of each technique, limitations of the techniques, problem detection, troubleshooting and the technical and clinical interpretation of results (iv) Interpret, evaluate and explain the laboratory presentation of specific clinical conditions and situations

Theme	Syllabus
Haemopoiesis **MLO (i)**	• Development, morphology and function of all normal and abnormal haemopoietic cells in bone marrow and blood • Role of haemopoietic growth factors, especially those in clinical use • Role, distribution and physiology of haematinics specifically, iron, vitamin B12 and folic acid in both health and disease
Pre-analytical phase **MLO (ii)**	Pre-analytical variables including sample collection, handling, stability, storage and transport
Laboratory techniques and principles **MLO (iii)**	• Principles of automated cell counting • Operation and limitations of the other automation including staining machines, slide makers, ESR analysers • Factors affecting the staining of blood films • Performance of the morphological examination of peripheral blood and bone marrow films and body fluids and how these aid in the diagnosis of haematological conditions • Performance, effectiveness and limitations of manual tests including, ESR, reticulocytes, Heinz bodies, rapid screening tests for infectious mononucleosis (IM) and malaria • Principles of flow cytometry and how this is used in the routine haematology laboratory • Investigation of blood borne parasites • Strategies and standards applied to reporting laboratory results including the units and selection of reference ranges

Clinical conditions and situations **MLO (iv)**	*Haematological non-malignant conditions* • Anaemias – macrocytic, microcytic, haemolytic, hypoplastic, blood loss • Thalassaemia and haemoglobinopathies • Erythrocytosis – reactive and malignant • Red cell breakdown/degradation • Benign disorders of white blood cells • Thrombocytosis and thrombocytopenia • Haematology of conditions including pregnancy and infections • Haematology in the neonate, childhood, elderly *Haematological malignancies* • Chronic and acute leukaemia • Myeloproliferative disorders • Myelodysplastic neoplasms • Lymphoproliferative disorders • Immunoproliferative disorders

Assessment	Assessment in this module consists of a three-hour written examination. The exam has two parts: • 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). • 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).

Learning resources	*Reference books - the current editions of:* Bain BJ, Bates I, Laffan MA. *Dacie and Lewis Practical Haematology*. Elsevier Bain BJ. *Blood Cells: A Practical Guide*. John Wiley & Sons Carr JH. *Clinical Hematology Atlas*. Elsevier Greer JP, Arber DA, Glader B, List AF, Means Jr RT, Praskevas F, Rodgers GM. *Wintrobe's Clinical Hematology*. Lippincott Williams & Wilkins Hoffbrand AV, Higgs DR, Keeling DM, Mehta AB (eds). *Postgraduate Haematology*. Wiley-Blackwell Hoffbrand V, Steensma DP. Hoffbrand's *Essential Haematology.* Wiley-Blackwell Hoffman R, Benz Jr EJ, Silberstien LE, Heslop H, Weitz J, Anastsi J. *Hematology: Basic Principles and Practice*. Elsevier Keohane EM, Otto CN, Walenga JM. *Rodak's Hematology: Clinical Principles and Applications*. Elsevier

	Journals American Journal of Hematology Archives of Pathology and Laboratory Medicine Australian Journal of Medical Science Bailliere's Clinical Haematology Blood Blood Reviews British Journal of Haematology CAP Today Clinical and Laboratory Haematology Hematology/Oncology Clinics of North America International Journal of Laboratory Haematology Journal of Clinical Pathology Laboratory Hematology Lancet New England Journal of Medicine Seminars in Hematology *Web-based resources (all accessed XXXX)* A laboratory guide to Clinical Haematology https://open.umn.edu/opentextbooks/textbooks/a-laboratory-guide-to-clinical-hematology Inherited Haemoglobin Disorders https://www.intechopen.com/books/inherited-hemoglobin-disorders Merck Manuals https://www.merckmanuals.com/professional/hematology-and-oncology University of Prince Edward Island lectures http://people.upei.ca/eaburto/Hematopoietic.htm

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Haematology II

Module	HAEMOSTASIS
Aim	To develop and apply expert knowledge, investigative practice and clinical skills relevant to haemostasis and thrombosis.
Module learning outcomes (MLO)	On completion of this module the candidate will be able to: (i) Discuss the normal mechanisms of haemostasis (ii) Discuss the pre-analytical factors that may impact the quality of the sample and the test results (iii) Describe and appraise investigations performed in the coagulation laboratory (iv) Interpret, evaluate and explain the laboratory presentation of specific clinical conditions and situations (v) Relate specific clinical aspects to coagulation testing (vi) Discuss the types of anticoagulant therapies and laboratory procedures used in monitoring treatment levels (vii) Discuss the principles, applications and limitations of Point of Care Testing (POCT)

Theme	Syllabus
Mechanisms of haemostasis **MLO (i)**	• Clotting factors and their inhibitors • Fibrinolytic proteins and their inhibitors • Vascular endothelium interactions • Platelet function • Activation pathways, signals and controls
Pre-analytical phase **MLO (ii)**	The impact of collection and pre-analytical variables on laboratory results including: • anticoagulants in use • specimen handling, stability, storage and transport • special requirements
Laboratory techniques and principles **MLO (iii)**	*Coagulation testing* • PT, INR, APTT, TT correction methods • Fibrinogen, fibrin/fibrinogen degradation products • Mixing studies • DIC screening • Clotting based factor assays • HIT screening • Thrombophilia testing • vWD testing *Reagents* • Suitability and selection of reagents including sensitivity of reagents to various technical and clinical factors • Thromboplastins including calculation of ISI • Partial thromboplastins including determination of sensitivity to heparin, lupus anticoagulant and coagulation factor levels • Buffers, activators, inhibitors of fibrinolysis

	Automation and instrumentation • Major instruments in use, recent developments and innovations • Technical and clinical value of specific technologies such as TEG and ROTEM • Centrifugation • Refrigeration and freezers – their role in management of reagents and specimens
Clinical conditions and situations **MLO (iv), (v)**	• Acquired coagulation disorders including those seen in DIC, liver disease, trauma, post-surgery, infection • Hereditary coagulation factor deficiencies • Acquired and hereditary thrombophilia • Platelet dysfunction • Haemostasis in pregnancy; in the neonate; in childhood • Strategies and standards applied to reporting laboratory results including units and selection of reference ranges
Anticoagulant therapy **MLO (vi)**	• Traditional and emerging anticoagulants • Monitoring the anti-coagulated patient • Tests used, factors affecting results and the interpretation of results including therapeutic ranges
Point of Care Testing **MLO (vii)**	• Usefulness and efficacy • Advantages and disadvantages of current instrumentation

Assessment	Assessment in this module consists of a three-hour written examination. The exam has two parts: • 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). • 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).

Learning resources	*Reference books – the current edition of:* DeLoughery TG (ed). *Hemostasis and Thrombosis*. Springer International Publishing Keohane EM, Otto CN, Walenga JM. *Rodak's Hematology: Clinical Principles and Applications.* Elsevier Key NS, Makris M, Lillicrap D eds. *Practical Hemostasis and Thrombosis*. John Wiley & Sons doi:10.1002/9781118344729 Kitchens CS, Kessler CM, Konkle BA, Streiff MB, Garcia DA. Cons*ultative Hemostasis and Thrombosis*. Elsevier Marder VJ, Aird WC, Bennett JS, Schulman S, White II GC. *Hemostasis and Thrombosis. Basic Principles and Clinical Practice*. Lippincott Williams and Wilkins Pierce A, Pittet JF. 2014. *Practical understanding of hemostasis and approach to the bleeding patient in the OR*. Advances in Anesthesia 32(1):1-21. doi: 10.1016/j.aan.2014.08.009 Saba HI, Roberts HR (eds). *Hemostasis and thrombosis: Practical Guidelines in Clinical Management*. John Wiley & Sons

	Journals American Journal of Hematology Archives of Pathology and Laboratory Medicine Australian Journal of Medical Science Clinical and Laboratory Haematology International Journal of Laboratory Haematology Journal of Thrombosis and Haemostasis Laboratory Hematology Seminars in Thrombosis and Hemostasis Thrombosis and Haemostasis Thrombosis Research *Web-based resources* Merck Manuals https://www.merckmanuals.com/professional/hematology-and-oncology Practical Haemostasis https://practical-haemostasis.com/

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Haematology III

Module	ADVANCED HAEMATOLOGY
Aim	To interpret, validate and reflect critically upon advanced technical, molecular mechanisms and clinical knowledge in the comprehensive investigation of cellular and haemostatic disorders.
Module learning outcomes	On completion of this module the candidate will be able to: (i) Demonstrate advanced knowledge of the principles, performance, limitations and corrections to investigations for the detection, diagnosis, classification and monitoring of haematological disorders (ii) Describe the cytogenetic and molecular basis of haematological disorders (iii) Prescribe, perform and evaluate cytogenetic and molecular investigations for the diagnosis and classification of haematological disorders (iv) Discuss the management of haemostatic disorders (v) Critically review Point of Care Testing (POCT) in haematology and haemostasis diagnostics (vi) Discuss the quality control systems applied in the diagnostic haematology and haemostasis laboratories

Theme	Syllabus
Laboratory techniques and principles **MLO (i), (ii)**	• Advanced flow cytometry including markers and panels for haematological malignancies • Cytogenetics including FISH and microarrays • Molecular studies for detection and monitoring of haematological and haemostatic conditions • Immunoassays • Haemoglobinopathy investigations (capillary and gel electrophoresis and HPLC) • Thromboelastography • Factor and inhibitor assays • Platelet function testing • vWD testing • Thrombophilia testing • Stem cell collection, assay and transplantation • Bone marrow collection, assay and transplantation • Prenatal genetic studies – sampling methods and analytics
Clinical conditions and situations **MLO (ii), (iii)**	*Haematological non-malignant conditions* • Anaemias – macrocytic, microcytic, haemolytic, hypoplastic, blood loss • Thalassaemia and haemoglobinopathies • Erythrocytosis – reactive and malignant • Red cell breakdown/degradation • Benign disorders of white blood cells • Thrombocytosis and thrombocytopenia • Haematology of conditions including pregnancy and infections • Haematology in the neonate, childhood, elderly

	<u>*Haematological malignancies*</u> • Chronic and acute leukaemia • Myeloproliferative disorders • Myelodysplastic neoplasms • Lymphoproliferative disorders • Immunoproliferative disorders
Clinical conditions and laboratory procedures related to haemostasis MLO (iv)	• Bleeding and fibrinolytic disorders • Thrombophilia and other inherited disorders • Platelet function/defect disorders • Anticoagulant therapy monitoring • Management of haemostatic disorders including coagulation factor therapy and factor replacement options • Management of blood loss and massive transfusion
Point of Care Testing in haematology and haemostasis diagnostics MLO (v)	• Usefulness and efficacy • Advantages and disadvantages of current instrumentation
Quality procedures MLO (vi)	Quality system and quality control issues relevant to haemostasis and haematology diagnostics

Assessment	Assessment in this module consists of a three-hour written examination. The exam has two parts: • 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). • 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).

Learning resources	<u>*Reference books - the current editions of:*</u> Bain BJ, Bates I, Laffan MA. *Dacie and Lewis Practical Haematology*. Elsevier Bain BJ. *Blood cells: A Practical Guide*. John Wiley & Sons Carr JH. *Clinical Hematology Atlas*. Elsevier Greer JP, Arber DA, Glader B, List AF, Means Jr RT, Praskevas F, Rodgers GM. *Wintrobe's Clinical Hematology*. Lippincott Williams & Wilkins Hoffbrand AV, Higgs DR, Keeling DM, Mehta AB (eds). *Postgraduate Haematology*. Wiley-Blackwell Hoffbrand V, Steensma DP. *Hoffbrand's Essential Haematology.* Wiley-Blackwell Hoffman R, Benz Jr EJ, Silberstien LE, Heslop H, Weitz J, Anastsi J. *Hematology: Basic Principles and Practice.* Elsevier Keohane EM, Otto CN, Walenga JM. *Rodak's Hematology: Clinical Principles and Applications*. Elsevier Key NS, Makris M, Lillicrap D (eds). *Practical Hemostasis and Thrombosis*. John Wiley & Sons doi:10.1002/9781118344729 Kitchens CS, Kessler CM, Konkle BA, Streiff MB, Garcia DA. *Consultative Hemostasis and Thrombosis*. Elsevier

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Haematology IV

Module	**ADVANCED PRACTICE** **LEADERSHIP, MANAGEMENT AND SUPERVISION**
Aims	To explore innovative technologies and to describe the knowledge and attributes required for leadership as a clinical scientist and Haematology / Haemostasis laboratory manager.
Module learning outcomes	On completion of this module the candidate will be able to: (i) Critically evaluate relevant research to predict and prepare for emerging laboratory practices and directional shifts (ii) 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) (iii) Discuss the models in use and provision of pathology services in Australia (iv) Describe the principles of pathology laboratory accreditation and the procedures necessary to gain and maintain accreditation (v) Formulate and evaluate operational requirements in the Haematology / Haemostasis laboratory including occupational health and safety, standard operating procedures, laboratory information systems and all records and databases (vi) Specify the attributes necessary for a leadership and supervisory role as a clinical scientist and laboratory manager

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

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

Assessment	Assessment in this module consists of a three-hour written examination. The exam has two parts: • 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). • 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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