



AUSTRALIAN INSTITUTE OF
MEDICAL AND CLINICAL SCIENTISTS

Fellowship Discipline Modules

Transfusion Science

Australian Institute of Medical and Clinical Scientists (AIMS)

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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.

Transfusion Science I

Module	LABORATORY-BASED TRANSFUSION SERVICE
Assumed knowledge	Immunohaematology techniques and principles.
Aim	To develop and apply expert knowledge, investigative practice and clinical skills relevant to the routine Transfusion Science laboratory.
Module learning outcome	On completion of this module the candidate will be able to: (i) Discuss the immune mechanisms that may impact transfusion of blood (ii) Explain the biochemical, molecular and genetic aspects of blood group systems (iii) Explain and evaluate the principles, procedures, any specific requirements and effectiveness of techniques routinely performed in the Transfusion Science laboratory (iv) Describe the limitations, problem detection and successful troubleshooting of the techniques routinely performed in the Transfusion Science laboratory (v) Interpret, evaluate and explain the basis and laboratory presentation of specific clinical conditions and situations

Theme	Syllabus
Immune response mechanisms MLO (i)	<ul style="list-style-type: none"> • The functions of T cells and interaction between T cells, antigen processing cells and B cells • Role of associated chemokines and immune response genes • Self-recognition/tolerance and mechanisms of autoimmunity • Factors influencing interaction between antigens, antibodies & complement • The immunomodulatory effects of transfusion
Blood group systems MLO (ii)	<ul style="list-style-type: none"> • ABO, Rh, Kell, Duffy, Kidd, P, Le, H, MNSs • Newly identified blood groups • The genetic basis for the major antigens of the known red cell blood group systems, including their gene frequencies • Molecular structure forming the basis of DNA-based methods and for determining the commonly used phenotypes of the ABO, Rh, Kell, Fy, Jk, MNSs systems
Laboratory techniques MLO (iii), (iv)	<ul style="list-style-type: none"> • Pre-transfusion blood collection requirements • ABO blood grouping techniques, monoclonal reagents, lectins, ABO variants and causes of ABO discrepancies • Rh blood grouping techniques, monoclonal reagents, and characterisation of RhD variants • Pre-transfusion testing: antibody screening, antibody investigations and identification, crossmatching (serological and electronic) and selection of blood products • Specialised techniques: DAT, elutions, red cell adsorptions, DTT, neutralisations, enzyme methods, HPC absorptions • Automated testing in the transfusion laboratory

	<ul style="list-style-type: none"> • Transfusion reaction investigations • Strategies and standards applied to reporting of laboratory results and other findings
Clinical practice MLO (v)	<ul style="list-style-type: none"> • Haemolytic transfusion reactions • Febrile, non-haemolytic transfusion reactions

Assessment	<p>Assessment in this module consists of a three-hour written examination.</p> <p>The exam has two parts:</p> <ul style="list-style-type: none"> • 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).
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Learning resources	<p><u>Reference book - the current edition of:</u> Harmening DM. <i>Modern Blood Banking & Transfusion Practices</i>. FA Davis Simon TL, Gehrie EA, McCullough J, Roback JD, Snyder EL. <i>Rossi's Principles of Transfusion Medicine</i>. Wiley</p> <p><u>Journals</u> Transfusion Transfusion Medicine Transfusion Medicine Reviews Vox Sanguinis</p> <p><u>Web-based resources</u> ANZSBT – Australian & New Zealand Society of Blood Transfusion http://www.anzsb.org.au ARCBS – Australian Red Cross Lifeblood http://www.lifeblood.com.au</p>
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Transfusion Science II

Module	BLOOD DONATION REFERENCE LABORATORY IMMUNOHAEMATOLOGY TISSUE TRANSPLANTATION
Aim	To develop and apply specialist knowledge, investigative practice and clinical skills relevant to blood donation, reference laboratory techniques, tissue typing and transplantation.
Module learning outcomes (MLO)	On completion of this module the candidate will be able to: (i) Explain the blood donation process from donor selection to collection, processing, and testing of donor blood (ii) Discuss the role and evaluate Reference Laboratory Testing (iii) Describe and interpret: * genotyping-and sequencing of red blood cell, HNA, HLA and HPA antigens * HNA, HLA and HPA antibody investigations * Immunogenetics for tissue typing and HSC transplantation

Theme	Syllabus
Blood donation MLO (i)	<ul style="list-style-type: none"> Blood donor selection, collection, mandatory serological and infectious diseases testing, traceability, special requirements, storage, transport, inventory management, quality, contingency planning, ISBT128 labelling Range of cellular and plasma products produced by Red Cross Lifeblood and CSL Behring
Reference laboratory immunohaematology MLO (ii)	<ul style="list-style-type: none"> Advanced serological techniques Mechanisms and diagnostic utility of molecular tests including genotyping for RBC, WBC and platelet antigens, sequencing Resolving complex antibody investigations using different techniques Specialised techniques, lectins for polyagglutination, adsorptions, elution, neutralisation, enzyme techniques and use of different chemicals Methods to distinguish HTLA vs high incidence antibodies
Transplantation MLO (iii)	<ul style="list-style-type: none"> HPA nomenclature, types of antibodies causing thrombocytopenia, laboratory tests to detect and identify platelet antigens and antibodies and clinical consequences of platelet antibodies HNA nomenclature, types of antibodies causing neutropenia, laboratory tests to detect and identify neutrophil antigens and antibodies and clinical consequences of neutrophil antibodies Principle and rationale for molecular genotyping from a blood donor centre, transfusion service or reference laboratory perspective

	<ul style="list-style-type: none"> • Genetic structure and function of HLA, HLA testing and HLA matching for transplantation • Stem cell collection and quality control • The serological anomalies resulting from haemopoietic stem cell and solid organ transplantation • Selection of appropriate blood group for blood products transfused to patients transplanted with ABO and RhD mismatched haemopoietic stem cells • Collection, transportation, and storage of autologous eye drops
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Assessment	<p>Assessment in this module consists of a three-hour written examination.</p> <p>The exam has two parts:</p> <ul style="list-style-type: none"> • 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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Learning resources	<p><u>Reference book - the current edition of:</u> Harmening DM. <i>Modern Blood Banking & Transfusion Practices</i>. FA Davis Simon TL, Gehrie EA, McCullough J, Roback JD, Snyder EL. <i>Rossi's Principles of Transfusion Medicine</i>. Wiley</p> <p><u>Journals</u> Transfusion Medicine Transfusion Transfusion Medicine Reviews Vox Sanguinis</p> <p><u>Web-based resources</u> ANZSBT – Australian & New Zealand Society of Blood Transfusion http://www.anzsb.org.au ARCBS – Australian Red Cross Lifeblood http://www.lifeblood.com.au Virtual Tour of Lifeblood Collection and Processing Centre Transfusion Online Learning of the Health Professionals (Lifeblood website under 'Stand-alone modules') https://learn.transfusion.com.au/course/view.php?id=766 (Log-in to your online learning account and then take the virtual tour)</p>
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Transfusion Science III

Module	CLINICAL TRANSFUSION PRACTICE
Aims	To develop and apply specialist knowledge, investigative and clinical skills relevant to current and emerging Transfusion Science practice.
Module learning outcome (MLO)	On completion of this module the candidate will be able to (i) Identify, evaluate and explain the laboratory and clinical presentation of specific conditions (ii) Appraise the role of viscoelastic (ROTEM, TEG, ClotPro and Quantra) testing in transfusion science (iii) Discuss and apply clinical principles in the operation of a transfusion science laboratory

Theme	Syllabus
Clinical practice MLO (i), (ii)	<ul style="list-style-type: none"> • Clinical indications and contraindications for different blood cellular and plasma products • Transfusion guidelines applicable to <ul style="list-style-type: none"> ○ acute and chronic transfusion ○ neonatal, perinatal and paediatric transfusion ○ obstetric transfusion practice • Antenatal blood group serology, Rh(D) Ig provision • Detection of fetomaternal haemorrhage and management • Staining and reading of KHT • Flow cytometry principles and operation in fetomaternal haemorrhage (FMH) • Calculation of FMH volume • Detection and investigation of Haemolytic Disease of the Foetus and Newborn (HDFN) <ul style="list-style-type: none"> • Cell free fetal DNA genotyping (NIPT and NIPA) and its application to prenatal diagnosis in the context of transfusion practice and HDFN • Foetal and Neonatal Alloimmune Thrombocytopenia (FNAIT) and Foetal and Neonatal Alloimmune Neutopenia (FNAIN) • Massive transfusion and critical bleeding, massive haemorrhage protocol (MHP) activation, product rations, monitoring and co-ordination • MHP outside the hospital setting, provision of blood products to emergency medical retrieval services • Viscoelastometric testing (ROTEM, TEG, ClotPro and Quantra): principles, applications, interpretation of results and provision of plasma, platelets, cryoprecipitate, fibrinogen concentrate or tranexamic acid • Provision of blood in difficult situations • Autoimmune haemolytic anaemias • Adverse transfusion events including immune and non-immune • Monoclonal antibody therapy • Out of Hospital (OOH) transfusions including risks vs benefits and current guidelines

Blood selection and storage MLO (iii)	<ul style="list-style-type: none"> • Impact of testing and donor unit selection for transfusion • Alternative storage of products • Improving the quality of blood products • Fibrinogen concentrate vs cryoprecipitate • Whole blood vs component therapy • MHP product ratios • Alternatives to blood
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Assessment	<p>Assessment in this module consists of a three-hour written examination.</p> <p>The exam has two parts:</p> <ul style="list-style-type: none"> • 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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Learning resources	<p><u>Reference book - the current edition of:</u> Harmening DM. <i>Modern Blood Banking & Transfusion Practices</i>. FA Davis Simon TL, Gehrie EA, McCullough J, Roback JD, Snyder EL. <i>Rossi's Principles of Transfusion Medicine</i>. Wiley</p> <p><u>Journals</u> Transfusion Medicine Transfusion Transfusion Medicine Reviews Vox Sanguinis</p> <p><u>Web-based resources</u> ANZSBT – Australian & New Zealand Society of Blood Transfusion http://www.anzsb.org.au ARCBS – Australian Red Cross Blood Lifeblood http://www.lifeblood.com.au</p>
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Transfusion Science 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 Transfusion Science laboratory manager.
Module learning outcomes (MLO)	On completion of this module the candidate will be able to: <ul style="list-style-type: none"> (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 Transfusion Science 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 Transfusion Science MLO (i)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Quality management components of ISO15189 in pathology laboratories • Quality control, quality assurance and quality management • Standardisation • Quality audit processes
Pathology in Australia MLO (iii)	<ul style="list-style-type: none"> • The organisation and delivery of 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

<p>Practice and accreditation standards MLO (iv)</p>	<ul style="list-style-type: none"> • 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 Transfusion Science laboratory
<p>Laboratory operations MLO (v)</p>	<p><u>Functional requirements</u></p> <ul style="list-style-type: none"> • 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 Transfusion Science laboratory • MSDS and Standard Operational Procedures (SOP) • Processes and requirements for workplace inspections <p><u>Risk assessment and risk management</u></p> <ul style="list-style-type: none"> • 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 • Green laboratories – ISO standards • Federal and state waste protocols
<p>Leadership and supervision in the Transfusion Science laboratory MLO (vi)</p>	<p><u>Principles of Leadership</u></p> <ul style="list-style-type: none"> • 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 <p><u>Managing people</u></p> <ul style="list-style-type: none"> • 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 <p><u>Managing resources</u></p> <ul style="list-style-type: none"> • Financial probity • Time Management Skills • Lean management principles in pathology

Assessment	<p>Assessment in this module consists of a three-hour written examination.</p> <p>The exam has two parts:</p> <ul style="list-style-type: none"> • 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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Learning resources	<p><u>Reference books – the current edition of:</u> McPherson RA, Pincus MR. <i>Henry's Clinical Diagnosis and Management by Laboratory Methods</i>. Elsevier Health Sciences</p> <p><u>Journals</u> American Journal of Clinical Pathology Australian Journal of Medical Science New Zealand Journal of Medical Laboratory Science British Medical Journal Clinical Laboratory Medicine</p> <p><u>Web-based resources</u> Public Pathology Australia https://publicpathology.org.au/ Australian Pathology https://www.australianpathology.com/ National Pathology Accreditation Advisory Council (NPAAC) https://www1.health.gov.au/internet/main/publishing.nsf/Content/health-npaac-index.htm NATA http://www.nata.com.au/ TGA and IVD http://www.tga.gov.au/industry/ivd-regulatory-requirements.htm Pathology Funding Agreement (2012) MBS Schedule Category 6 – Pathology WorkSafe Australia https://www.safeworkaustralia.gov.au/</p>
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