



Department of Health
Government of Western Australia
Metropolitan Health Service

Laboratory Reference Intervals

For Biochemistry, Haematology, Immunology and Toxicology



PathWest Laboratory Medicine WA
QEII Medical Centre Site
Laboratory Reference Intervals
For Sir Charles Gairdner Hospital and
QEII Medical Centre

QEII Medical Centre

Results & Enquiries **13** PATH
7284

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FOR RESULTS PHONE 13 PATH (13 7284)

(Biochemistry, Cytology, Haematology, Histopathology, Immunology, Virology and Toxicology)

Central Reception Area (CRA)

(24 Hours) Monday - Sunday
For above results

9346 2637 (SCGH)
137284 (External)

Telephoned Results

It is best to keep these to a minimum since the possibility of introducing an error is large. Patient results are available on Sunrise Clinical Manager (SCGH).

The reports are delivered via the hospital chute at 0700, 1100, 1400 and 1700 hrs on weekdays and at 1130 on Saturdays and Sundays. To obtain a result by telephone ring 9346 2637 and quote the patient's unit number, name and the results required.

BIOCHEMISTRY

Biochemistry operates a 24-hour, seven-day a week service. A/H Medical Scientist page 4605. A Duty Biochemist is available at all time on 9346 2782. The Head of Department is Dr Ee Mun Lim (93461054).

Routine Laboratory Hours

Monday - Friday:

0830-1700 hrs

Saturday and Public Holidays:

0830-1200 hrs (restricted service)

Sunday:

Out-of-hours service only

On weekends and public holidays non-urgent and time-consuming analyses will not be performed. Samples may be collected but will not be analysed until the next working day.

Any request made outside normal laboratory hours should satisfy the criterion that the result is expected to affect significantly the immediate treatment of the patient.

A limited range of analyses are available out-of-hours. Only those tests which are required should be requested (eg. order K only rather than urea and electrolytes). The tests are done on a discrete analyser.

Out-of-Hours: The following tests are available:

Blood pH, pO₂, pCO₂, Sodium, Potassium, Chloride, Ionised Calcium, Glucose, Lactate, Haemoglobin, Carboxyhaemoglobin and Methaemoglobin.

Plasma	Sodium	Alkaline Phosphatase	BNP
	Potassium	Alanine Aminotransferase	Chloride
	Bicarbonate	Aspartate Aminotransferase	Osmolality
	Urea	Gamma Glutamyl Transferase	C Reactive Protein
	Creatinine	Calcium	Iron Studies
	Glucose	Magnesium	Lipids
	Total Protein	Phosphate	Paracetamol
	Albumin	Creatine Kinase	Ethanol
	Bilirubin	cTroponin T	

Therapeutic drugs: Gentamicin, Tobramycin, Vancomycin, Lithium, Carbamazepine, Digoxin, Phenytoin, Phenobarbitone, Theophylline, Valproate, Salicylate.

Serum β-hCG Pregnancy Test

CSF Protein Glucose Xanthochromia

Urine Potassium Porphobilinogen
Sodium Osmolality

Other tests may be available in special circumstances but only after consultation with a senior member of the laboratory staff, please page the Shift Scientist on 4605.

HAEMATOLOGY

Haematology is located on the second floor, J Block. The Head of Department is Dr Jill Finlayson (9346 2554).

The following services are provided:

- Routine Haematology.
- Coagulation.
- Bone Marrow Examination (procedure requires booking, phone Haematology Care Centre 9346 2618).
- Flow Cytometry.
- Transfusion Medicine.

Request Forms:

- PathWest Laboratory Medicine WA Request Form: for all requests except transfusion.
- Transfusion Medicine Form: for all transfusion requests (including blood group, antibody screen and crossmatch).
- Blood Product Request Form: to request delivery of pre-ordered crossmatched blood and blood products (including FFP, platelets and albumex) via the SCGH pneumatic tube.

A completed Request Form must accompany all specimens.

Hours of Service:

Haematology operates a 24-hour seven-day service. A Haematologist is available 24 hours for advice on laboratory testing, result interpretation and transfusion advice.

During office hours (08:30 – 17:00) the Duty Haematologist can be contacted on 9346 2890 and the Haematology Registrar on 9346 2405.

After hours, the on-call haematologist may be contacted through the SCGH switchboard (9346 3333). Ask for the PathWest on-call Haematologist or Registrar.

The A/H Medical Scientist is available through the SCGH switchboard (9346 3333) on page 4415.

TRANSFUSION GUIDELINES**PACKED RED CELLS**

- Background** Blood for transfusion is provided as packed (concentrated) red cells with a haematocrit of 0.55 - 0.65 and volume of 250-350mL. There is only a very small volume of plasma in a unit of packed cells. One unit of packed cells will increase the Hb by approximately 10g/L.
- Indications**
- Active bleeding.
 - Prior to urgent surgery and haemoglobin less than 100g/L.
 - Post-operative haemoglobin less than 80g/L.
 - Symptomatic anaemia.
 - Anaemia associated with increased oxygen requirement, respiratory or cardiac decompensation.
 - Bone marrow infiltration or suppression.
 - Do NOT use packed cells as a volume expander.
- Ordering**
- For surgical patients: ordering in accordance with the hospital Maximum Surgical Blood Order Schedule (MSBOS).
 - Units of blood and when required (eg. urgent, 3 hrs, date of surgery).
 - Blood Group and Antibody Screen/Hold (G&S or G&H).
 - If leucocyte depleted, irradiated or CMV-negative blood is required, this must be stated on the crossmatch request form (in consultation with the Haematologist).
- Samples**
- 10mL EDTA blood sample.
 - Crossmatch Request Form.
- Special Features**
- Leucocyte depletion to prevent immunisation.
 - Irradiation: to prevent transfusion associated graft-versus-host disease in immunosuppressed patients.
 - CMV-negative blood for CMV-negative immunosuppressed patients.

- Administration**
- Same ABO group as patient and crossmatched.
 - Blood giving set over 1-4 hours.
 - Discard blood remaining in the pack after 4 hrs.
 - Can be leucocyte depleted at the bedside with leucocyte depletion filter.
 - Do not flush through filters at the completion of the transfusion.

- Adverse Reactions**
- Haemolytic transfusion reaction (eg. ABO compatibility).
 - Fever, rigors, dyspnoea, pain, headache, abnormal bleeding.
 - Allergic reactions – oedema, urticaria, wheezing.
 - Anaphylaxis; febrile reaction; circulatory overload.
 - Transmission of infectious disease.
 - Metabolic complications – hypothermia, citrate toxicity, acidosis.
 - Alloimmunisation of the recipient.

NOTE All transfusion reactions should be investigated to establish the cause.

PLATELETS

Background Platelet transfusions protect patients from serious haemorrhage when they are thrombocytopenic (eg. secondary to bone marrow failure or haematologic malignancy) or when the platelet count falls to $<15 \times 10^9/L$. Platelets can be provided as Random Donor Platelets (5.5×10^{10} platelets in 40-70mL plasma; 4-6 units per transfusion episode) or Single Donor Platelets (3×10^{11} in 300mL). Both should give a platelet increment of approximately $30 \times 10^9/L$ at 1 hour. A significant proportion of patients become immunised to HLA antigens due to contaminating leucocytes.

- Indications**
- | | |
|-------------|---|
| Prophylaxis | <ul style="list-style-type: none">- Platelet count $< 15 \times 10^9/L$.- Platelet count $< 50 \times 10^9/L$ and planned surgery or invasive procedure. |
| Therapeutic | <ul style="list-style-type: none">- Platelet count $< 50 \times 10^9/L$ and bleeding. |

- Ordering**
- 10mL EDTA blood for blood group and Crossmatch Request Form.
 - Cross-matched platelets may be required if HLA or platelet specific antibodies are present.
 - **Approval for Platelets must be obtained from the Haematology Registrar or Duty Haematologist.**
- Samples**
- ABO blood group needs to be known.
 - 10min – 1hr post-transfusion platelet count to assess post-transfusion platelet response/increment.
- Special Features**
- Bedside filtration of RDP (if indicated): Do not flush filter.
 - Irradiation to prevent transfusion associated graft-versus-host disease in immunosuppressed patients.
 - CMV-negative for CMV-negative patients.
- Administration**
- Platelets of the patient's ABO group should be given.
 - Transfuse through platelet giving set.
 - DO NOT USE STANDARD BLOOD GIVING SET.
 - The volume of D positive red cells is insufficient to cause immunisation (if Rh-D positive units are given) to Rh-D negative recipient. There is no indication for anti-D Ig.
- Adverse Effects**
- Immediate – febrile and allergic reactions.
 - Delayed – refractoriness (allo-immunisation).
- Points to Note**
- Weekly platelet antibody screens to be performed on regularly transfused patients.
 - Patients may be refractory to platelet transfusions for immune or non-immune reasons. If platelet antibodies are detected order crossmatch compatible RDP or HLA-matched SDP.

FRESH FROZEN PLASMA (FFP)

- Background** Fresh Frozen Plasma is obtained from whole blood donations. The plasma is removed following collection and rapidly frozen to preserve labile clotting factors. FFP contains all the proteins normally present in plasma but is used as a source of coagulation factors. One unit of FFP is derived from one unit of blood. The volume of each unit of FFP is approximately 200 – 250mL.
- Indications**
- FFP is indicated for the control of bleeding in patients with abnormal coagulation and where no specific therapy is available. Specific indications are:
 - Documented coagulation factor deficiency and bleeding or an invasive procedure planned.
 - Patients with a coagulopathy who are actively bleeding or an invasive procedure planned (eg. Warfarin therapy; liver disease; DIC).
 - Reversal of the haemostatic defect in coagulopathy following massive transfusion.
 - Replacement therapy for plasma exchange.
 - Do NOT use FFP when a coagulopathy can be corrected more effectively with specific therapy, such as vitamin K, Prothrombinex or AHF.
 - Do not use FFP as a plasma volume expander.
- Ordering**
- Approval for FFP use must be obtained from the Haematology Registrar (9346 2405 o/h) or Duty Haematologist (9346 2890 o/h, switchboard on 9346 3333 a/h).
 - An INR result must be available when ordering FFP. In general, FFP will not be issued if the INR < 1.4.
 - A maximum of 2 units of FFP can be ordered at one time.
- Samples** 10 mL EDTA sample for ABO blood group.

- Administration**
- FFP must be ABO compatible.
 - FFP is stored at -30°C in PathWest Laboratory Medicine WA QEII MC Transfusion Medicine Unit and thawed immediately prior to use. Thawing takes up to 30 minutes.
 - Transfuse through a standard blood giving set.
 - The rate of administration should not exceed 10mL/min (ie. 20-30 minutes per unit of FFP). Transfusion of FFP should not exceed 2 hours per unit.
 - An average dose of FFP varies between 5-15mL/kg body weight.

NOTE Clinical and laboratory assessment of the patient's coagulation status is important in monitoring the effect of FFP.

- Adverse Effects**
- Allergic reactions (urticaria and febrile reactions) are common.
 - Transmission of infectious agents.
 - Febrile, haemolytic and allergic reactions.
 - Large volumes of FFP: citrate toxicity, other metabolic problems.

CRYOPRECIPITATE

- Background** Cryoprecipitate is prepared from fresh plasma and is rich in Factors VIII (100 units) and XIII, Von Willebrand factor and fibrinogen (150mg). One unit of cryoprecipitate is derived from one unit of blood. The volume varies between 20-30mL.
- Indications**
- Active bleeding or a scheduled invasive procedure in patients with documented:
 - Haemophilia A (when AHF not available).
 - Von Willebrand's disease (when AHF not available).
 - Significant hypofibrinogenaemia. (Dose = 1 unit/10kg).
 - Dysfibrinogenaemia.
 - Factor XIII deficiency.
 - Intraoperative production of fibrin glue (1 unit only).
- Ordering** **Approval for Cryoprecipitate must be obtained from the Haematology Registrar** (9346 2405 o/h) or Duty Haematologist (9346 2890 o/h, switchboard on 9346 3333 a/h).
- Samples** 10 mL EDTA sample for ABO blood group.
- Administration**
- Cryoprecipitate should be ABO compatible.
 - Cryoprecipitate is stored frozen at -30°C in PathWest Laboratory Medicine WA QEII MC Transfusion Medicine Unit and is thawed immediately prior to use.
 - Cryoprecipitate must be transfused immediately after thawing.
 - Transfuse through a standard blood giving set.
 - The rate of transfusion must not exceed 10mL/min.
 - The dose of cryoprecipitate must be determined individually.

NOTE The presence of anti-A and anti-B antibodies in cryoprecipitate from Group O donors may cause haemolysis if transfused to Group A or Group B recipients.

NOTE Clinical and laboratory assessment of the patient's coagulation status is important in monitoring the effect of cryoprecipitate.

Adverse Effects

- Allergic and febrile reactions are common.
- Cryoprecipitate may transmit infectious agents.

4% ALBUMIN (Normal Serum Albumin; 4% Albumex)

Background 4% Normal Serum Albumin (4% Albumex) is a 4% protein solution prepared from pooled human plasma by CSL Limited. It is iso-osmotic with human serum. 4% Albumex has been heat-treated at 60°C to inactivate viruses. It is packaged in 50mL and 500mL bottles and stored in PathWest Laboratory Medicine WA QEII MC Transfusion Medicine Unit.

Indications

- Hypovolaemic shock.
- Cardiopulmonary bypass.
- Therapeutic plasma exchange.

Administration - IV administration through a standard IV infusion giving set.

Adverse Reactions

- Allergic reactions.
- Circulatory overload.
- Hypotension – rare.

20% ALBUMIN (Normal Serum Albumin; 20% Albumex)

Background Normal Serum Albumin is a 20% protein solution prepared from plasma and stored at 2-8°C. NSA has been heat-treated to inactivate Hepatitis B and C and HIV. 20% NSA is prepared by CSL Limited. 100mL bottles are stored in PathWest Laboratory Medicine WA QEII Transfusion Medicine Unit.

Indications

- 20% albumin is indicated in:
 - Hypoproteinaemic states.
 - Nephrotic syndrome.
 - Liver failure.
 - Ascites.
 - Massive burns.

NOTE Albumin is hyperoncotic and is therefore NOT indicated in the resuscitation of shocked patients. 20% albumin is also NOT indicated for nutritional support.

Administration

- 20% albumin is given intravenously through a standard IV infusion giving set at the rate of 1-2mL/minute.
- The dose is determined from the serum albumin and the desired albumin level.

Adverse Reaction Adverse reactions to 20% albumin are uncommon.

Ordering Haematologist approval required for issue of 20% NSA (9346 2405 o/h) or Duty Haematologist (9346 2890 o/h, switchboard on 9346 3333 a/h).

Rh (D) IMMUNOGLOBULIN

- Background** Rh(D) immunoglobulin suppresses the immune response in Rh(D)-negative individuals who have received Rh(D)-positive blood (eg. from fetomaternal haemorrhage, or transfusion of platelets contaminated by Rh(D)-positive red cells). 1 ampoule Rh(D) immunoglobulin contains 625 IU or 125µg antibody which will protect against 6mL of Rh(D)-positive red cells.
- Indications** To an Rh(D)-negative woman within 72 hours of delivery of an Rh(D)-positive infant (or stillbirth, abortion or miscarriage).
- Administration**
- 1 ampoule of Rh(D) immunoglobulin within 72 hours intramuscularly.
 - An antibody screening test should be done 24-48 hours after the injection to check that sufficient Rh(D) immunoglobulin has been given. If anti-D is detected the dose has been adequate.
 - This product must NOT be given intravenously as anaphylactic reactions can occur.
- Adverse Reaction**
- Reactions are uncommon.
 - Mild pyrexia, malaise and urticaria have been reported.
 - For thrombocytopenic patients, care must be taken when administering Rh(D) immunoglobulin intramuscularly in response to the platelet transfusion, the dose of Rh(D) immunoglobulin should be delayed until the platelet count has increased ($>80 \times 10^9/L$). Alternatively, Rh(D) immunoglobulin can be administered subcutaneously to thrombocytopenic patients.
- NOTE** Short supply of Rh(D) immunoglobulin in Australia limits its use to obstetric indications.

IMMUNOLOGY

The Immunology Laboratory is located on the first floor of J Block. The Clinical Director is Dr Peter Hollingsworth (9346 2833 or mob 0417 977 468). The Registrar is available on 9346 4814 or pager 4163.

For consultations please telephone the secretary on ext 2833 or page the Registrar on 4163. Outpatient Clinics are held on Tuesday and Thursday mornings in C Link within E Block and appointments can be made on extension 3105.

Normal Laboratory hours are Mon-Fri 0800–1700. There is an on-call Scientist available until 2400 Mon-Fri and 0600–1800 weekends and public holidays (mob 0419 969 474). For all urgent and/or after normal hours requests, in the first instance, please contact the on-call Immunology Consultant or Registrar to discuss which tests are actually required. The on-call Consultant is available via the **RPH** switchboard (phone 9224 2244).

The Department of Clinical Immunology offers inpatient and outpatient services and consultations concerning suspected allergy, autoimmune diseases, immune deficiency, HIV infection, urticaria, SLE, scleroderma and connective tissue diseases, vasculitis and transplantation immunology, among others. It also provides immediate hypersensitivity skin testing, and Mantoux tests (9346 3691) for human and avian tuberculosis.

HISTOPATHOLOGY

The Histopathology section, Anatomical Pathology, PathWest Laboratory Medicine QEII MC is located on Ground floor, J Block East. The Head of Department Anatomical Pathology is Dr Greg Sterrett (9346 2643). The Histopathology section provides a comprehensive diagnostic service for referred clinical tissue biopsies including rapid frozen section analysis and also provides histopathology services for material referred from post-mortem examinations. The Histopathology section also provides histochemical and immunohistochemical staining services for referred material as determined by the complexity of the referred case. Anatomical Pathology also provides specialist diagnostic services including cytology, electron microscopy and molecular diagnostic testing on referred material.

REQUEST FORMS

There is a universal PathWest Laboratory Medicine WA Request Form for all these services and it is essential that full information be provided on the form, including the WARD, name of the CONSULTANT, and PAGER number for urgent results.

BIOPSIES

Frozen Sections (Bookings: 9346 2526)

Diagnostic Histopathology should be notified on 9346 2526, preferably at least 24 hours before the frozen section is required. After the specimen has been sent and examined the pathologist will contact the theatre indicated on the request form by the PAX intercom or by phone.

Routine Reports

Histopathology reports are normally dispatched within 48 hours of the arrival of the tissue in the Section. The turn-around-time for reporting includes essential time for tissue fixation in formalin and subsequent paraffin processing, sectioning, an examination of tissue sections by pathology registrars and pathologists using a range of techniques determined by the complexity of the case. Small biopsies which fix quickly can be processed in the same day and reports issued within 24 hours. Other samples may take longer because of their size or because of special procedures required due to complexity of the diagnosis.

Typed reports will be dispatched to the Consultant responsible for the patient from whom the biopsy was taken and will be addressed to the patient's Ward or Clinic as indicated on the request form.

Procedure

Make sure that specimens are placed in plenty of formalin - this should be 20 times the volume of the specimen. Do not use a container that is too small for the specimen.

For thick or large specimens, fixation may be difficult or delayed and some specimens may need to be opened or incised to allow better access for the formalin. If in doubt bring the specimen to Histopathology personally and prepare the tissue for fixation together with the pathologist.

Fresh tissue requiring non-histopathology tests should NOT be placed in formalin. This applies to tissues or parts of biopsy specimens for microbiological culture, immunological studies, chemical analysis, special histochemistry and for all lymph node biopsies. Such specimens should be sent FRESH to the laboratory without delay. For lymph node biopsies, particularly cases of suspected lymphoma, the fresh tissue should be sent promptly from the theatre to the laboratory. For muscle and nerve biopsies, which are special procedures, the laboratory must be notified in advance providing details, including time of operation and theatre location, to 9346 2526.

Out of Hours

For urgent out of hours requests for Histopathology and Anatomical Pathology services contact the Duty Histopathologist via the Sir Charles Gairdner Hospital switchboard on 9346 3333.

Whenever in doubt or whenever there is an unusual clinical or special problem regarding Histopathology, contact the Duty Histopathologist.

CYTOLOGY

The Cytology section is located on the first floor, J Block East. The-Head of Department is Dr Felicity Frost (9346 2730). The Section provides a full range of diagnostic cytological services including pathologist-attended Fine Needle Aspiration Cytology.

General Information for Medical Staff

Optimal preservation of cellular material for cytodiagnosis requires careful attention to detail in the collection of material, fixation and slide preparation, all of which vary according to the sites and type of sample.

Diagnosis may require the use of special techniques such as cell block preparations, immunocytochemistry and electron microscopy. Cytology staff may need to be involved in the collection of material for these purposes.

Complete clinical information, particularly in the case of patients with a previous history of malignant neoplasm, is essential for accurate cytodiagnosis.

For questions regarding the preparation of Cytological material and the requests for urgent reports on cytological material contact the rostered Cytopathologist on 9346 2138.

For urgent out of hours cytology requests contact the Duty Cytopathologist via the Sir Charles Gairdner Hospital switchboard on 9346 3333.

To make a booking for Fine Needle Aspirations in the wards or outpatient clinics, phone 9346 2138. A completed Request Form should be left in the front of the patient headsheet.

Bookings for deep aspirations (eg. intrathoracic, intra-abdominal or bony lesions requiring radiological control or bone lesions requiring nuclear medicine control) are to be made with the respective departments. A completed Request Form should be left in the front of the patient's headsheet.

Please note the following specimen requirements in regard to collection of samples for cytological analysis:

Exfoliative Cytology

Sputum Cytology

At least 3 specimens should be sent to the Cytology laboratory, to maximise the likelihood of diagnosis: separate early morning deep cough specimens are most suitable; physiotherapy assisted specimen collection may be of value.

Bronchial Brushings

Slides should be fixed in alcohol within seconds of preparation. If fixation is not immediate, air drying of the cells occurs, rendering accurate assessment impossible.

Bronchio - Alveolar Lavage

Specimens for the diagnosis of opportunistic lung infections should be sent directly to the Cytology laboratory. The purpose of the investigation should be clearly marked on the request form. The Cytology laboratory should be notified when the specimen is likely to arrive in the department.

Serous Effusions

At least 180mL of the effusion should be sent to the laboratory in the body fluid bottles available on the wards or at PathWest Regional Laboratories. All of the aspirated fluid should be sent if possible. Repeat specimens are often of value, as initial specimens may show degenerative change in cells.

Urine Samples

The second early morning sample is optimal and more than 100mL should be sent if possible. The first early morning sample often contains only degenerate cells and is less suitable. Since cells rapidly degenerate in urine, the specimen is to be sent immediately to the Cytology laboratory after collection. The entire sample is required (NOT a mid-stream specimen).

CSF

This specimen is particularly susceptible to degeneration and slides must be prepared immediately. CSF specimens cannot be left overnight. If CSF is taken for cytology out of hours, the Duty Cytopathologist is to be contacted via the Sir Charles Gairdner Hospital switchboard on 9346 3333.

Fine Needle Aspiration

Superficial palpable lesions:

Optimal results are achieved if the Cytopathologist performs aspirations of superficial sites such as breast, thyroid, lymph nodes, subcutaneous tissue, soft tissue and prostate. To make a booking for a Pathologist attended fine needle aspiration in the wards or outpatient clinics, phone 9346 2138. A completed Request Form should be left in the front of the patient headsheet.

*Bookings for SCGH & Metropolitan PathWest Laboratory Medicine WA branches should be made on **9346 2138**.*

If the clinician wishes to perform the Fine Needle Aspiration, at least 3 smears from 3 separate needle passes is recommended. Air-dried smears are preferred. If there is abundant material, rapid fixation of one slide with a spray fixative is of value.

A fine needle aspiration kit is available at all PathWest Regional Laboratories and contains instructions and all necessary consumables. The Regional Laboratory will pack the specimen and send it to Cytology for reporting.

Deep Lesions

In general, aspirations of intra-thoracic or intra-abdominal lesions will require radiological or ultrasound localisation. Bookings can be made with the Radiology Department (9346 2233). Palpable intra-abdominal lesions (eg liver) can be aspirated on the ward by the Cytopathologist (9346 2138).

Lesions of bone are generally best localised radiologically or by nuclear scan and aspirated in these departments. If the bone lesion is palpable and cortical erosion is likely, these lesions can be aspirated by the Cytopathologist (9346 2138). **Impalpable breast lesions** must be localised using stereotaxis or ultrasound and should be booked through the relevant radiology department.

PathWest Laboratory Medicine WA FNA Clinics are located at:

NEDLANDS:	SCGH J Block, Hospital Avenue by appointment; Mon – Fri. Ph: 9346 2138
ARMADALE:	Armadale-Kelmscott Hosp, Albany Hwy by appointment; Tues a.m. Ph: 9391 2030
BALCATTA:	Sterling Radiology, U23/257 Balcatta Rd. by appointment; Mon, Tues, and Thurs. Ph: 9345 5666
BENTLEY:	Bentley Hosp. B Block, Mills St. by appointment; Tues p.m. Ph: 9334 3720
INNALOO:	Unit 2/8 Odin Rd. by appointment; Tues and Thurs p.m. Ph: 9244 9080
MANDURAH:	U6/5 Murdoch Dr. by appointment; Wed a.m. Ph: 9582 7988
ROCKINGHAM:	Rockingham Family Centre, Wilmott Dr. by appointment; Wed a.m. Ph: 9528 4355

Gynaecological Cytology

Cervical smear kits are available from PathWest Regional Laboratories and hospital wards. Each kit consists of a request form, glass slide, slide carrier, cytobrush and spatula. A full 360° sweep of the cervix with these devices is recommended followed by immediate fixation with a spray fixative to provide optimum preservation.

Ancillary procedures are also available (ThinPrep, PAPNET, and HPV DNA testing by PCR). For information in regard to costs of these tests, and specimen requirements for these ancillary tests contact Cytology on 9346 2138.

Semen Analysis (PathWest Regional Laboratories)

For infertility investigations, the sample is to be collected after 2 – 7 days of abstinence from ejaculation. The sample is obtained by masturbation, ejaculation into a yellow-topped sterile container, and delivered to the PathWest Regional Laboratories within one hour of collection.

For post-vasectomy specimens the time to analysis is not as critical, and the specimens can be delivered up to several hours after collection, or even overnight.

For further information, contact Dr Bret Snowball on 9346 4598.

ELECTRON MICROSCOPY

The Electron Microscopy Section is a specialist diagnostic laboratory within the Division of Anatomical Pathology, which provides clinical diagnostic ultrastructural analysis by utilising transmission and scanning electron microscopy. Element microanalysis by Energy Dispersive Analysis of X-rays (EDAX) is also performed within this laboratory. Please contact either Dr Dominic Spagnolo (9346 2953), Prof. John Papadimitriou (9346 2769), or the Electron Microscopy laboratory (9346 2933) for further information.

MOLECULAR PATHOLOGY

The Molecular Pathology section is a specialist diagnostic laboratory that provides molecular testing services for the diagnosis and classification of malignant lymphoproliferative disorders in both solid tumours, blood and bone marrow. Clinical samples can be referred to the section for molecular testing following consultation with Dr Dominic Spagnolo (9346 2953). For information in regard to costs of these tests and specimen requirements for molecular testing contact the Molecular Pathology laboratory on 9346 2679.

MOLECULAR GENETICS

The Molecular Genetics section provides specialist molecular testing for a range of genetic disorders. All tests can be performed on a 5mL EDTA plasma sample. Further information on the tests provided and turn-around times for the tests is available by contacting Dr John Beilby (9346 2368) or the Molecular Genetics laboratory on 9346 2903.

NECROPSIES

Necropsies can only be done where the doctor has completed a Medical Certificate of Cause of Death. Before a post-mortem can be performed, permission must be sought and obtained from the next of kin and a consent form completed. Please contact the Post-Mortem Coordinator (via SCGH switchboard on 9346 3333) for assistance with completion of the consent form. Other cases may become Coroner's cases and the doctor should clear any doubtful cases with the Coroner's Clerk 9488 3444.

In addition to the Medical Certificate of Cause of Death, two forms must be completed:

1. The NECROPSY REQUEST FORM giving details of the clinical history and signed by the requesting clinician. If special information or a particular clinico-pathological correlation is sought at post-mortem, indicate this on the Necropsy Form or discuss it with the pathologist. Indicate if there is any infection risk (eg. Hep B, Hep C, HIV).
2. The POST-MORTEM EXAMINATION CONSENT FORM signed by the next of kin, the requesting clinician, a Designated Officer and the Post-Mortem Coordinator (the list of Designated Officers and PM Coordinators is available from the office of the Director of Corporate Medical Services). If the requesting clinician anticipates that tissue or organs may need to be retained at post-mortem, this should be discussed with the next-of-kin. If next of kin permission is for only a limited post mortem this must be so indicated on the Post-Mortem Examination Consent Form. The completion of a Post-Mortem Examination Consent Form is a legal requirement under the *Non-Coronial Post-Mortem Examinations Code of Practice 2002*.

When the necropsy nears completion, the doctors who may be interested, particularly if they are identified on the Necropsy Request form, will be contacted and the findings discussed with them in the Mortuary theatre. Subsequently, a brief summary report of the gross findings will be issued. Later the more detailed macroscopic and microscopic descriptions together with the final summary will be available.

For any problem or whenever in doubt, discuss with the rostered Histopathologist on Necropsy (9346 2138).

PATIENT DEATH - NON-CORONIAL (MEDICAL CERTIFICATE OF CAUSE OF DEATH) CASES AND CORONERS CASES

1. Notification

The medical practitioner who attended a person in his/her last illness (even briefly) should complete and sign the Medical Certificate of Cause of Death as soon as is practicable. Delay may unnecessarily interfere with funeral arrangements, and increase the distress of the bereaved family.

A Certificate of Cause of Death should not be completed if the death is reportable to the Coroner.

Deaths which are reportable to the Coroner include:

1. Death that appears to have been unexpected, unnatural or violent, or to have resulted, directly or indirectly, from injury (irrespective of the period of time between the initial injury and the death).
2. Death that occurs during an anaesthetic.
3. Death that occurs as a result of an anaesthetic and is not due to natural causes.
4. Death that occurs in prescribed circumstances (at the Coroner's discretion).
5. Death of a person who immediately before death was a person held in care.
6. Death that appears to have been caused or contributed to while the person was held in care.
7. Death that appears to have been caused or contributed to by any action of a member of the Police Force.
8. Death of a person whose identity is unknown.
9. Deaths that occur in Western Australia where a Medical Certificate of Cause of Death under section 41(1)(a) of the *Registration of Births, Deaths and Marriages Act 1961* has not been completed or signed.
10. Deaths that occurred outside Western Australia where the cause of death is not certified.

The Certificate of Cause of Death is to be completed by:

1. A Medical Practitioner who attended the patient; and who is
2. Reasonably certain of the cause of death, based on clinical grounds.

When a patient dies in the Accident and Emergency department as a result of that recognised disease, but after only a brief time in that department, a Medical Certificate of Cause of Death may be completed if there is clinical support for the diagnosis. Alternatively, the Medical Certificate may be completed by the General Practitioner or a member of the patient's usual hospital unit.

If, for whatever reason, a Certificate of Cause of Death cannot be completed, the death is reportable to the Coroner.

In some circumstances you may wish to discuss the death with the Coroner's Office:

1. Death in association with surgery, anaesthesia or a medical investigative procedure.
2. When there are complaints about the medical treatment.
3. If there is doubt about the cause of death or the circumstances of the death.

2. Making Contact with the Coroner

1. Definite notification (all hours) - phone the Coronial Inquiry Unit (CIU) of the Police Department on 9222 1111.
2. To discuss doubtful cases:
 - Office hours: Coroner on 9488 3444
 - After hours: phone the Coroner's office directly on 9488 3444 or phone the CIU and ask to be put in touch the with Coroner's office.

3. Unexpected Death in Operating Theatre

1. If a patient dies during a surgical procedure, and because of the life threatening nature of the medical condition could be reasonably expected to do so (eg. rupture of abdominal aortic aneurysm), then there is no need to report the death to the Coroner.
2. If however, the cause of death is not known, or the death is unexpected, or is attributable to anaesthesia, then the death should be reported:
 - Notify the Coroner as in 2 (above).
 - Have another anaesthetist and technician check the anaesthetic equipment.
 - Retain with the body all medication containers.
 - Leave all tubes, drains etc. in-situ.

4. Care of the Body and Clothing After Death

1. All lines and tubes should be left attached to the body and secured, including endo-tracheal tubes.
2. All medication, ampoules and containers which have had or still do contain substances administered to the patient should be preserved and dispatched with the body. However, if these items have been placed in a sharps container with items from other patients, they need not be retained and may be disposed of in the prescribed way.
3. Any injury should **not** be cleaned or otherwise interfered with after death.
4. Any tissue, foreign material, skin, etc. (including blood samples), removed during treatment should be made available for forensic examination.
5. Clothing should not be removed from the deceased. Clothing that has been removed prior to death should be sealed in a secure bag and dispatched with the body.

5. Identification of the Body

Formal identification of the deceased is a requirement for non-coronial and coronial deaths. Where necessary, identification is performed by the next of kin or forensic identification procedures.

6. Human Tissue and Transplant Act 1982

The next of kin's consent is legally required for the removal of tissue or organs from non-coronial cases (and must be so indicated on the Post-Mortem Examination Consent Form) in accordance with the *Human Tissue and Transplant Act 1982 (WA)* and the *Non-Coronial Post-Mortem Examinations Code of Practice 2002*.

In the investigation of coronial deaths, the consent of the Coroner is required for the removal of tissue or organs in accordance with the *Coroners Act 1996 (WA)*.

CLINICAL PHARMACOLOGY & TOXICOLOGY**General**

A completed PathWest Laboratory Medicine WA Request Form must accompany requests for all assays. Please note that the person collecting the sample must complete all the dose and sample details in the appropriate areas of the form. Without this information, the results will be uninterpretable.

Most assay results are available within 24 hours of receipt of the sample. The request form for an urgent assay must be identified with a red sticker.

Normal working hours are 0800 - 1630 Monday to Friday. Urgent assay requests outside these hours are dealt with by the after-hours Biochemistry Medical Scientist (page 4605).

A Clinical Pharmacologist is available for consultations at all times and can be contacted on 9346 2987 (SCGH Dept. of Clinical Pharmacology and Toxicology) during normal working hours or through the SCGH switchboard on 9346 3333 after hours.

Drug Screens

Most emergency toxicology needs can be met by use of the 'mini screen' or by a request to identify a specific drug.

Therapeutic Drug Monitoring/ Toxicology Services

Quantitative plasma level measurements for a wide range of drugs are routinely available. Details of sample required, special instructions and usage ranges are given in this PathWest Laboratory Medicine WA Reference Range Manual.

Digoxin Assays - Ideal Sampling Times

Plasma Digoxin measurement is mainly indicated to avoid potential toxicity. Digoxin is however an unusual drug in that after oral administration its absorption and distribution are slow, resulting in high plasma levels in the first few hours after dosage. These are not representative of tissue concentrations. What is required is to sample at a time after a dose when the plasma concentration will show its best correlation with the level in the myocardium. Studies indicate that this is achieved by sampling **11 hours after the last oral dose** (in practice we recommend a minimum time of 8 hours). The drug has a very long half-life and hence even samples taken 24-27 hours after dose are satisfactory. A high Digoxin result for a sample taken in the first few hours after dosage will not enable one to differentiate between concentrations which are potentially toxic, within or below the usual range (0.5-0.8µg/L) and the assay is thus much less helpful.

Antibiotic Assays - Aminoglycosides

Directions for sampling are provided on a card, which is available from the Clinical Pharmacology Laboratory (9346 2194). The card also provides instruction for dosage adjustment. Computer-assisted dose prediction is available through ward pharmacists or the Drug Information Service (9346 2923). Clinical inquiries may be directed to the on-call Microbiologist.

MICROBIOLOGY AND INFECTIOUS DISEASES

General Information

Microbiology and Infectious Diseases occupies most of K Block. Foods/Waters and Enteric are located on the ground floor. Bacteriology/Mycology/Mycobacteriology on the first floor and Virology/Serology (including PCR) on the second floor. The division provides a comprehensive microbiology service for diagnostic testing and clinical consultation. Dr David Smith is the Clinical Director (9346 3122) and is supported by three Consultants; Dr Clay Golledge (9346 3625 page 4368), Dr Tim Inglis (9346 3461 page 4450) and Dr David Speers (9346 2197 page 4133). There is also a Registrar on 9346 2568, pager 4298. All Consultants and the Registrar are also available via the Sir Charles Gairdner Hospital switchboard on 9346 3333. Mr Rod Bowman is the Principal Scientist (9346 3908 page 4608).

The routine PathWest Laboratory Medicine WA Request Form can be used, and must be submitted with all specimens. Adequate clinical histories should be provided on the Request Form as it greatly assists the laboratory in selecting appropriate investigations. Information regarding specimen collection and laboratory tests is available in the body of this manual, but we encourage prior consultation with the laboratory in unusual or difficult circumstances. This is particularly true in cases where multiple investigations are required when little specimen is available. Early discussion with the laboratory can help choose the most appropriate investigations.

Laboratory Hours	Monday – Friday	Saturday	Sun/Public Holidays
Bacteriology/Mycology/TB	0830 – 2130	0900 – 1630	0900 - 1630
Virology/Serology	0800 - 1730	0800 - 1500	on-call only
Enteric	0830 – 1700	0830 – 1630	0900 – 1200

Service outside the hours above is by on-call roster. The Medical Scientist on-call for Bacteriology can be reached via the Sir Charles Gairdner Communications Centre. They should only be called for urgent specimens where the result will have an immediate impact on patient management. Medical staff requesting the service of the on-call scientist may be required to obtain clearance via discussion with the on-call Clinical Microbiologist. Requests for urgent after hours virology/serology should be directed to the on-call Clinical Microbiologist via the Sir Charles Gairdner Hospital switchboard on 9346 3333.

Clinical Advice

During routine hours clinical advice can be obtained by contacting one of the Consultants. After hours advice is available from the on-call Clinical Microbiologist via the Sir Charles Gairdner Hospital switchboard on 9346 3333. Outpatient appointments for Infectious Diseases can be made by ringing 9346 3625.

Reference Ranges

Due to the nature of microbiology and serology it is not practical to provide a wide range of numerical reference ranges as would be found in disciplines such as Biochemistry and Haematology. The reference ranges in the booklet include most bacteriology specimens where cell counts form a part of the report (listed alphabetically under “Bacteriology Examinations”). Many Microbiology reports will contain interpretive comments and we encourage consultation with laboratory staff if further interpretation is required.

SPECIMEN COLLECTION

Recommended drawing order of blood samples

1. Sterile samples (eg blood cultures).
2. Citrate.
3. Serum (Clot Activator and Gel tubes).
4. Heparin and Heparin Gel.
5. EDTA.
6. Fluoride Oxalate (Glucose).

Specimen Collection - In-Patients

The Request Form should be **FULLY** completed and all specimens labelled with patient name, and UMRN or DOB, and left on the ward in the position specified for that ward. The collection of out-of-hours specimens is the responsibility of the doctor requesting the test. Please collect a sufficient number of tubes for all tests requested and note on the right hand side of the form the number of each type of tube collected. There is a main ward collection by phlebotomy staff at 0700 every day (Mon - Sun). Forms should be completed and placed in the 'specimen collection' tray on each ward before this time.

Smaller rounds are conducted at 1000 and 1300 Monday - Friday, for repeat tests. These rounds should not be used for normal routine tests (which should be done at 0700), but are for serial tests or missed bleeds due to patient movement. Requests need to be placed in the 'specimen collection' trays by this time.

Specimen Collection - Out-Patients

Samples of blood, urine, faeces and sputum will be taken by laboratory staff in Specimen Collection on the ground floor of the Diagnostic Unit (E Block) from 0800 hrs to 1700 hrs, Monday to Thursday. Outpatients should be given a completed Request Form and directed to the area. If a fasting sample is required the patient should be asked to go the specimen collection area at 0800 hrs on the required day.

Prior arrangements should be made for special tests, e.g. glucose tolerance test, ischaemic lactate test etc. The telephone extension for making these arrangements is 9346 3281.

ALPHABETICAL LISTING OF TEST

1-25 Dihydroxycholecalciferol (1-25 diOHD) pmol/L*Serum* 50 - 155

Refer to Duty Biochemist prior to collection of specimen. To lab ASAP. 2ml blood required. Results of this assay for patients receiving Calcitriol (Rocacrol) are meaningless without a record of the time and amount of last dose.

5 Flurocytosine mg/L*Serum or plasma (no gel)* Less than 100

Sample at peak. Collect 5ml blood.

5-Hydroxyindole Acetic Acid $\mu\text{mol/day}$ *Urine* 5 - 37

24 hr urine with 20ml 50% HCL preservative, refrigerate during storage, protect from light and transport chilled. Assayed daily. Must record the volume on the Request Form once the specimen is received in laboratory.

ABO and Rh Typing

*

See: Blood Group.

Acetoacetate (Ketones)*Serum, Plasma, CSF, Urine (spot), Vitreous humour*

ACTH (Adrenocorticotrophic Hormone) pmol/L

EDTA plasma x 2 <10.0

Collect between 0800 and 0900, record date and time of collection on request form. Chill 2 x 5ml empty EDTA tubes on ice. Collect 10mls of blood and place into these iced EDTA tubes. Immerse tubes into an ice bath following collection. Deliver on ice to laboratory within 30 minutes of collection.

Activated Protein C Resistance Ratio

Citrate Plasma (x2) + EDTA 2.0 - 5.0
(x1) whole blood Equivocal range: 1.9 - 2.1

Included in Thrombophilia screen. To lab ASAP. Citrate tubes must be filled to mark.

AH 50 (Alternate Pathway CH 50) % of normal pool

Serum 50 - 150

To lab ASAP. Usually done with a CH 50, no additional sample required.

Alanine Aminotransferase (ALT) U/L

Plasma or Serum

0d-30d	<35
1m-11m	<40
1y-3y	<35
4y-16y	<30
>=17y Male	<40
>=17y Female	<35

Plasma preferred. ALT is a more sensitive marker for hepatitis C infection than AST.

Albumin

g/L

Plasma or Serum

0d-30d	25-40
1m-16y	32-48
>=17y	35-50
In Pregnancy	
12wk	33-43
24wk	29-37
36wk	28-36

Plasma preferred.

Albumin (Urine)

Urine (Timed overnight, spot or 24hr collection)

<20 ug/min	(Overnight collection, time stated)
<40mg/d	(24 hour collection)
<30mg/L	(Spot)
M <2.5 mg/mmol	Albumin/Creatinine Ratio
F <3.5 mg/mmol	Albumin/Creatinine Ratio

No preservative. Ideal specimen is timed overnight collection. Record collection times and volume.

1. Patient to empty bladder and discard urine before bed and note time.
2. Collect all urine passed during night and upon waking. Note time.

Albumin / Creatinine Ratio

mg/mmol

Urine (Spot or overnight)

M <2.5 mg/mmol
F <3.5 mg/mmol

No preservative.

Alcohol (Ethanol)

g%

Serum or Plasma (no gel tubes)

> 0.15 g% gross intoxication
> 0.4 g% potentially fatal

DO NOT use alcowipe.

Alkaline Phosphatase

U/L

Plasma or Serum

0-2m		100-420
3m-11y		100-350
12y-13y Female		70-260
14y-15y Female		50-220
16y-19y Female		40-135
12y-15y Male		100-350
16y-19y Male		50-200
>=20y		35-135
Pregnancy	12 wk	30-125
	24 wk	45-133
	36 wk	100-367

Plasma preferred.

Alkaline Phosphatase Isoenzymes

U/L

Serum or Plasma

Liver <85
Bone <90

Allegron

*

See: Amitriptyline / Nortriptyline

Allergy Skin Testing

*

Skin prick testing to detect immediate hypersensitivity is cheaper and quicker than measuring specific IgE by RAST. For appointment phone Immunology Clinic 9346-3691.

Alpha Fetoprotein (Blood)

Serum or plasma <11 kU/L Males and Non-Pregnant Females

Serum preferred.

Alpha-1-Antitrypsin (Quantitative)

g/L

<i>Serum</i>	0d-1m	0.6-2.0
	>=2m	0.9-2.0

Assayed daily. Genotyping is also available See: Alpha-1-Antitrypsin Genotype.

Alpha-1-Antitrypsin Genotype

*EDTA or lithium heparin
(whole bloods)*

MM, MZ, MS, SS, SZ or ZZ genotype. Minimum sample 5ml.

Aluminium (blood)

µmol/L

*Trace element tubes (Royal
Blue lids)* < 0.4

Performed on patients undergoing renal dialysis. Collect into blue top trace element tubes. Use approved brand only.

Amikacin

mg/L

Serum or Plasma (no gel tubes)

Peak level: >40

Trough level: < 5 (Ideally <2.5)

Peak levels should be taken 30 minutes after completion of infusion. Trough levels are taken immediately prior to the next dose. Collect 5ml sample.

Aminoterminal Propeptide of Type I Collagen (P1NP)*Serum or Plasma*

Separate and send chilled.

Amiodarone

mg/L

Serum or Plasma (no gel tubes)

Amiodarone concentrations > 3 mg/l may be associated with some adverse effects.

Sample just before next dose.

Amitriptyline / Nortriptyline

µg/L

Serum or Plasma (no gel tubes)

Usual range 50 - 200 µg/L of amitriptyline plus nortriptyline.

Collect 5ml blood. Sample at least 12 hours post dose. If dose changed reassay after 2 weeks.

AML1-ETO t(8;21) Translocation

Blood or bone marrow

Collection Volume:

10ml blood; 5ml bone marrow.

Minimum Collection Volume:

5ml blood; 2ml bone marrow.

Collection:

Blood: Collect in purple top (EDTA) tube; alternate container yellow top ACD tube.

Bone marrow: Collect aspirate into EDTA.

NOTE: The use of heparin anticoagulant may inhibit PCR.

Store at room temperature. Deliver to the laboratory without delay. Transport at room temperature; protect from temperature extremes. Do not use ice bricks in the transport container.

Must arrive within 24 hours of collection.

Ammonia

µmol/L

Heparin plasma

0-30d

<100

>=1m

<50

Place Heparin whole blood on ice. Send to laboratory immediately.

Amylase

U/L

Plasma or Serum

0d-30d	<30
1m-6m	<50
7m-11m	<80
>=1y	<100

Plasma preferred.

Androstenedione

nmol/L

Serum or Plasma

0-7d	1.1-15.2
8d-30d	0.9-4.2
1m-11m	0.3-3.6
1y-10y	0.5-2.6
>=17y	1.0-12.2

Tanner Stage; 11y-16y:

	Males	Females
1	0.5-2.6	0.5-2.6
2	1.0-3.9	1.0-5.1
3	1.0-5.9	1.0-9.6
4	1.0-8.2	1.0-11.3
5	1.0-12.2	1.0-12.2

Serum preferred.

Angiotensin Converting Enzyme (Serum)

U/L

Serum

Serum: 8 - 52

(Results will be low for patients taking ACE inhibitors)

Serum preferred, however Heparin plasma can be used. Specimen must be clear.

Antenatal Blood Group Serology*10 mls EDTA (whole blood)*

Negative

The specimen label MUST be signed by the collector or it will be rejected for testing.

Anti Erythropoietin Antibodies*Serum*

Transport chilled.

Anti-Acetylcholine Receptor Antibodies

Units

Serum

<1.0

Anti-Beta-2-Glycoprotein 1*Serum*

Anti-Beta-2-glycoprotein 1 antibodies are associated with thrombosis. Specimens are tested in a qualitative screening assay. Positive specimens are tested in quantitative assays for IgG, IgM and IgA antibodies to Beta-2-glycoprotein 1.

Anti-Cardiolipin

g/L

Serum

<5

1-2 ml serum.

Anti-Cholinesterase Antibody / receptors

*

See: Anti-Acetylcholine Receptor Antibodies

Anti-DNA Antibodies

IU/ml

Serum <7

1-2 ml serum.

Anti-Endomysial Antibodies

*

See: IgA Anti-tissue Transglutaminase

Anti-Extractable Nuclear Antigens

Pos/Neg

Serum Negative

1-2 ml serum. Includes antibodies to RNP, SSA(Ro), SSB(La), Sm, Jo-1, Pm-Scl, and Scl-70, histone and ribosomal.

Should also include ANA if ANA status is unknown.

Anti-Factor Xa

*

See: Low Molecular Weight Heparin

Anti-Filaggrin Antibodies

*

Test no longer performed. See Anti-Cyclic Citrullinated Peptide.

Anti-Glomerular Basement Membrane

EU/ml

Serum <20**Anti-Glutamic Acid Decarboxylase (Anti-GAD)**

units/ml

Serum <1.0

Anti-islet Cell Antibodies should be requested also.

Anti-Heart Antibodies

Local units

Serum 0**Anti-Hsp 70***Serum*

Assayed fortnightly. A marker for idiopathic, progressive, bilateral, sensorineural hearing loss.

Anti-Intrinsic Factor Antibodies

units/ml

Serum <10**Anti-Islet cell Antibodies**

JDF units

Serum <5**Anti-Liver-Kidney Microsomal Antibodies**

Local Units

Serum 0**Anti-M2 Mitochondrial Antibodies***Serum* % Inhibition

Assayed monthly. See also Anti-Mitochondrial antibodies.

Anti-Mitochondrial Antibodies

Local Units

Serum 0**Anti-Myeloperoxidase***Serum*

This is a specific assay for one antibody in the Anti-Neutrophil Cytoplasmic group.

Anti-Nerve Antibodies

Local Units

Serum 0**Anti-Neutrophil Cytoplasmic Antibodies**

Local Units

Serum 0 - 3

Positive samples are tested in the MPO and/or Anti-PR3 assays.

Anti-Nuclear Antibodies

IU/mL

Serum < 7 IU/ml in >95% of Busselton reference population.
>= 7 IU/ml in >95% untreated SLE.

Anti-Ovarian Antibodies

Local Units

Serum 0

Anti-adrenal and anti-mitochondrial antibody should be ordered simultaneously.

Anti-Parietal Cell Antibodies

Local Units

Serum 0

Anti-PR3 (Proteinase 3)*Serum*

This is a specific assay for one antibody of the Anti-Neutrophil Cytoplasmic group.

Anti-Purkinje Cell Antibodies*Serum*

0

Local units

Anti-Reticulin Antibodies (IgG & IgA)*Serum*

0

Local units

The clinical relevance of this antibody is its association with Coeliac disease, but IgA Anti-Endomysial Antibodies is a better test for Coeliac disease.

Anti-Ribosomal Antibodies*Serum*

0

Local Units

Anti-Saccharomyces Antibody*Serum***Anti-Skin Antibodies***Serum*

0

Local Units

Includes intercellular and junctional basement zone antibodies.

Anti-Smooth Muscle Antibodies*Serum*

0

Local Units

Anti-Striational Antibodies

Local Units

Serum 0**Anti-Thyroglobulin Antibodies**

kU/L

Serum <40**Anti-Thyroid Antibodies**

*

Replaced by Anti-Thyroid Peroxidase Antibodies

Anti-Thyroid Microsomal Antibodies

*

Replaced by Anti-Thyroid Peroxidase Antibodies

Anti-Thyroid Peroxidase Antibodies

kU/L

Serum or Plasma <6

Serum preferred

Antibody Screen*EDTA (Whole blood)*

10 ml of EDTA. More may be needed if difficulties arise. The specimen label MUST be signed by the collector or it will be rejected for testing.

APTT

Seconds

Citrate x 1

21 to 33

45 to 75 (heparin therapy) or ratio between 1.5 - 2.5

Citrate tubes must be filled to mark. Specimen must be tested within 4 hours of collection.

Ascaris (RAST)

Serum

Negative

Aspartate Aminotransferase

U/L

Plasma or Serum

0-7d	<100
8d-30d	<70
1m-6m	<65
7m-3y	<60
4y-6y	<50
7y-9y	<40
10y-11y Male	<60
12y-15y Male	<40
16y-19y Male	<45
>=20y Male	<45
10y-11y Female	<40
12y-15y Female	<30
16y-19y Female	<30
>=20y Female	<35

Plasma preferred.

Auto Antibodies*Serum*

Clinical history required. Specify individual autoantibodies required otherwise generally only ANA will be performed.

Avian Precipitin CIE*Serum*

Bird Fanciers disease.

B and T cell Gene Rearrangement Clonality Studies*Blood, marrow, lymph node*

Must consult with Duty Haematologist on 9346 2890 prior to collection.

Collection Volume:

10ml blood; 5ml bone marrow; 5 mm x 5 mm x 5 mm fresh tissue in tissue culture media.

Minimum Collection Volume:

5ml blood; 2ml bone marrow; 3 mm x 3 mm x 3 mm fresh tissue.

Collection:

Blood: Collect in purple top (EDTA) tube; alternate container yellow top ACD tube.

Bone marrow: Collect aspirate into EDTA. Fresh tissue: Collect in sterile container in RPMI tissue culture medium.

NOTE: The use of heparin anticoagulant may inhibit PCR.

Store in refrigerator. Do not freeze. Transport at room temperature; protect from temperature extremes.

BCL-1 t(11;14) - Mantle Cell Lymphoma

Blood or bone marrow

BCL-1 t(11;14) - Mantle Cell Lymphoma (major translocation cluster)

Collection Volume:

10ml blood; 5ml bone marrow.

Minimum Collection Volume:

5ml blood; 2ml bone marrow.

Collection:

Blood: Collect in purple top (EDTA) tube; alternate container yellow top ACD tube.

Bone marrow: Collect aspirate into EDTA.

NOTE: The use of heparin anticoagulant may inhibit PCR.

Store in refrigerator. Do not freeze. Transport at room temperature; protect from temperature extremes.

BCL-2 major breakpoint region and minor cluster region

Blood or bone marrow

BCL-2 major breakpoint region (MBR) and minor cluster region (mcr) - t(14;18)

Collection Volume:

10ml blood; 5ml bone marrow

Minimum Collection Volume:

5ml blood; 2ml bone marrow

Collection:

Blood: Collect in purple top (EDTA) tube; alternate container yellow top ACD tube:

Bone marrow: Collect aspirate into EDTA

NOTE: The use of heparin anticoagulant may inhibit PCR.

Store in refrigerator. Do not freeze. Transport at room temperature; protect from temperature extremes.

BCR-*abl* mutation studies (sequencing)

Blood or bone marrow

Collection Volume:

20ml blood; 5ml bone marrow.

Collection:

Notify the Molecular Haematology laboratory that a specimen is being collected.

Blood: Collect in purple top (EDTA) tube; alternate container yellow top ACD tube.

Bone marrow: Collect aspirate into EDTA.

NOTE: The use of heparin anticoagulant may inhibit PCR.

Store at room temperature. Deliver to the laboratory without delay. Transport at room temperature; protect from temperature extremes. Do not use ice bricks in the transport container.

Must arrive within 24 hours of collection.

BCR-abl Philadelphia Chromosome - t(9;22) major and minor.

Blood or bone marrow

BCR-abl Philadelphia Chromosome - t(9;22) major (M-BCR) and minor (m-bcr) breakpoints.

Collection Volume:

10ml blood; 5ml bone marrow

Minimum Collection Volume:

5ml blood; 2ml bone marrow

Collection:

Blood: Collect in purple top (EDTA) tube; alternate container yellow top ACD tube:

Bone marrow: Collect aspirate into EDTA

NOTE: The use of heparin anticoagulant may inhibit PCR.

Store at room temperature. Deliver to the laboratory without delay. Transport at room temperature; protect from temperature extremes. Do not use ice bricks in the transport container

Must arrive within 24 hours of collection.

Bence Jones Protein

*

See: Electrophoresis Protein (urine)

Beta-2-Microglobulin (Blood)

mg/L

Serum or plasma

< 2.0

Serum preferred.

Beta-2-Microglobulin (Urine)

mg/L

Spot Urine

<0.20

No preservative.

Beta-2-Transferrin

*

See: Beta Trace Protein

Beta-HCG (BHCG) - Qualitative test*Serum*Positive
Negative
Equivocal**Beta-HCG (BHCG) - Quantitative test**

IU/L

Serum or plasma

< 5

Serum
preferred.

For threatened abortion 2 samples are required, 48 hours apart. In normal pregnancy HCG increases by at least 60% each 48 hours for the first 8 weeks of pregnancy.

including in males with testicular cancer.

Can also be used as tumour marker,

Bicarbonate

mmol/L

Plasma or Serum

0 - 30d	18-27
1m - 11m	18-29
1y - 12y	20-30
>=13 y	22-32
Pregnancy 12 wk	18-29
24 wk	18-29
36 wk	18-29

Plasma preferred. Collect blood in a tightly sealed tube with as little air space as possible above the specimen.

Bilirubin (Conjugated)

µmol/l

Plasma or Serum

0-30d	<10
>=1m	<5

Plasma preferred. Prevent exposure to light (wrap in foil).

Bilirubin (Total)

µmol/L

Plasma or Serum

0d	<100
1-2d	<150
3-7d	<200
8-30d	not appropriate
>=1m	<20

Plasma preferred. Prevent exposure to light.

Biopsies for Immunology

Various

Contact laboratory.

Bleeding Time

minutes

In vivo test 2.5 - 10.0

NOTE: Haematologist approval required.

Blood Gases*Arterial or venous heparinised
whole blood*

Arterial or venous heparinised whole blood drawn and handled anaerobically to preserve gas tensions. Chute sample to lab within 10 minutes or place sealed syringe on crushed ice. Deliver to lab ASAP. (See Page 135 and 136 of the 2007 PathWest Laboratory Medicine WA Reference Intervals Manual for the Reference Intervals)

Blood Group*EDTA (Whole blood)*

10mL EDTA (whole blood) required. The specimen label MUST be signed by the collector or it will be rejected for testing.

Blood Group and Antibodies Screen*EDTA*

10ml of EDTA. The specimen label MUST be signed by the collector or it will be rejected for testing.

Bromide

mmol/L

*Serum or Heparinised Plasma
(no gel tube)* Bromide <0.6 mmol/L Toxic levels >12.5 mmol/L

Separate and transport chilled.

Bupivacaine

mg/L

Serum or Plasma (no gel tubes)

Toxicity likely at concentrations of >4

Collect 5 ml blood.

C-Peptide

nmol/L

Serum or Plasma

Fasting: 0.2 - 0.9

Serum preferred. Fasting specimen required, except when patient is hypoglycaemic.

C-Reactive Protein

mg/L

Plasma or Serum

0d	<7
1d-7d	<15
>7d QEII MC	<5
>7d Vitros	<10
Pregnancy	<15

Plasma preferred.

C1 Esterase Inhibitor

Serum

Request C3 and C4 simultaneously. Sample must be separated and frozen within 1hour of collection.

C3 (Complement)

g/L

Serum or Plasma

0.78 - 1.5

C4 (Complement)

g/L

Serum or Plasma

0.16 - 0.52

CA 125 (Tumour Marker for Ovarian cancer)

kU/L

Serum or plasma

<20

Serum preferred.

CA 15.3 (Tumour Marker for Breast Cancer)

kU/L

Serum or plasma

<54

Serum preferred.

CA 19.9 (Tumour Marker for Cancer of Pancreas)

kU/L

Serum or plasma

<40

Serum preferred.

Caeruloplasmin

g/L

Serum or Plasma

1m-11m	0.12-0.36
1y-15y	0.16-0.40
>=16y	0.17-0.45

Calcium (ionized)

mmol/L

Clot (Serum)

0d-2d	1.05-1.30
3d-14d	1.10-1.40
>=15d	1.12-1.32

Avoid venous occlusion during collection by releasing tourniquet ASAP. Fill clot tube as much as possible and delivered to the laboratory with minimal delay.

Calcium (Total)		mmol/L
<i>Plasma or Serum</i>	0- 7d	1.90-2.65
	8d-30d	2.15-2.75
	1m-11m	2.15-2.65
	>=12m	2.15-2.60 (random)
	>=12m	2.15-2.55 (fasting & supine)
	Pregnancy 12 wk	2.20-2.55
	24 wk	2.12-2.48
	36 wk	2.13-2.48

Plasma preferred. Avoid venous occlusion during collection by releasing tourniquet ASAP.

Calcium (urine)		mmol/day
<i>Urine</i>	>=17y	2.5-7.5

24 hr collection. Add 20 ml of 50% Acetic Acid OR 20 ml of 50% HCl

Calcium / Creatinine Ratio		mmol/mol
<i>Urine</i>	M 40 - 450	
	F 100 - 580	

Fasting spot urine (2ml), no preservative.

Campylobacter jejuni serology

Serum

Campylobacter pylori Serology

*

See: Helicobacter pylori Serology

Carbamazepine

mg/L

Serum or Plasma (no gel tubes) 6 - 12

Sample just before next dose. If dose changed, reassay after 7 to 10 days.

Carboxyhaemoglobin (Carbon Monoxide)

%

Heparin (whole blood) <6.0

Send whole blood to lab ASAP.

Carcinoembryonic Antigen

µg/L

Serum or Plasma <5

Reference range is for non smokers.

Serum preferred.

Cardiac Enzymes

Serum or Plasma

Defunct terminology. *** Please order "CK" and "Troponin-T" separately on the request form ***

Cardiac Troponin T (QEII MC)

ug/L

Lithium heparin plasma

Myocardial damage if ≥ 0.1
0.03 - 0.09 May suggest increased cardiac risk in the setting of acute coronary syndrome.
<0.03 Myocardial damage unlikely.

Carotene-Alpha

μmol/L

Serum (preferred) or Plasma <0.4
(Heparin or EDTA)

Prevent exposure to light. Wrap specimens in foil. Transport to lab with minimal delay.

Carotene-Beta

μmol/L

Serum (preferred) or Plasma 0.1 - 1.8
(Heparin or EDTA)

Prevent exposure to light. Wrap specimens in foil. Transport to lab with minimal delay.

Catecholamines (Urine)*Urine*

Collect 24hr Urine with 50% HCl preservative. For children (up to 18 years old), an acidified (50 % HCl preservative) spot urine is required. Assayed daily.

CBFB-MYH11 fusion gene (Inversion 16 or t(16;16))

Blood or bone marrow

Collection Volume:

10ml blood; 5ml bone marrow.

Minimum Collection Volume:

5ml blood; 2ml bone marrow.

Collection:

Blood: Collect in purple top (EDTA) tube; alternate container yellow top ACD tube.

Bone marrow: Collect aspirate into EDTA.

NOTE: The use of heparin anticoagulant may inhibit PCR.

Store at room temperature. Deliver to the laboratory without delay. Transport at room temperature; protect from temperature extremes. Do not use ice bricks in the transport container.

Must arrive within 24 hours of collection.

CD34

EDTA (whole blood)

Stem cell count by Flow Cytometry.

CD4/CD8 Ratio

*

See: Lymphocyte Subsets

CH 50

Serum

URGENT! To lab within 1 hour of collection.

Chloride

mmol/L

Plasma or Serum

0-7d	96-111
8d-6m	96-110
7m-12y	96-109
>=13y	98-108

Plasma preferred.

Cholesterol

mmol/L

Plasma or Serum

0d-3y	1.2 - 4.5
4y-16y	2.8 - 4.5
>=17 yr	< 5.5 (National Heart Foundation Ideal value)

Plasma preferred. Fasting specimen preferred.

Cholinesterase (organophosphates)

kU/L

*EDTA blood or Heparin blood
(no gel tubes)*

Plasma	5.3 - 12.9
RBC	8.0 - 15.0

EDTA blood is preferred. Heparin blood is also acceptable (no gel tubes). Minimum 5 mL of blood is required. Notify the testing laboratory if the request is required urgently. For occupational exposure to organophosphate pesticides. To laboratory ASAP.

NOTE: This is NOT Organochlorides (pesticides).

Clobazam / Desmethylclobazam

µg/L

*Serum or Plasma (no gel tubes)*200 - 800 for Clobazam
250 - 2150 for Desmethylclobazam

N.B. Range subject to considerable variability depending on other drug therapy.

Sample just before next dose. Minimum 2 mL of serum or plasma.

Clomipramine / Desmethylclomipramine

µg/L

Serum or Plasma (no gel tubes)

160 - 450 for sum of both compounds

Sample at least 12 hours post dose. If dose changes, reassay after 2 weeks. Minimum 2 mL of serum or plasma.

Clonazepam

µg/L

Serum or Plasma (no gel tubes)

15 - 90

Sample just before next dose. If dose changed, reassay after 4 - 6 days. Minimum 2 mL of serum or plasma.

Clozapine

µg/L

Serum or Plasma (no gel tubes)

Clozapine: >350

Sample just before next dose. Minimum 2 mL of serum or plasma.

Coagulation Factors

%

Citrate x 2

F II :	65 - 135	** (F2/fii)
F V :	50 - 150	** (F5/fv)
F VII:	65 - 135	** (F7/fvii)
F VIII:	50 - 200	** (F8P/fviii)
F IX :	50 - 200	** (F9/fix)
F X :	45 - 144	** (F10/fx)
F XI :	65 - 150	** (F11/fxi)
F XII :	50 - 150	** (F12/fxii)
VWF:	50 - 200	** (F8P/vwf)

Citrate tubes must be filled to mark. Send to Lab ASAP.

Coagulation Studies*Citrate x1*

Citrate tubes must be filled to mark. Includes INR, APTT. Must be tested within 4 hours of collection.

Cold Agglutinins*10ml clot (no gel tubes)*

Negative

Clotted blood. Keep sample at approx 37°C during and after collection & when transporting to lab.

Complement C4 & Bf Allotyping*EDTA Plasma or Serum or**ACD*

This test is ONLY available by prior consultation with RPH Immunology Dept (9224 2899) EDTA plasma preferred. To laboratory ASAP.

Coombs Test- Direct

EDTA (whole blood) Negative

Test for auto-immune haemolytic anaemia.

Copper

µmol/L

Serum or Plasma

6d-5m	5-16
6m-11m	5-23
1y-15y	11-28
>=16y	11-23

Minimum sample 0.6 ml but 1.0 ml preferred.

Copper (Liver)

Liver biopsy mmol/kg dry weight <0.6

Biopsy in 75ml screw top container. No formalin, saline or preservative.

Copper (Urine)

µmol/day

Urine < 0.5

24 hour urine with 20ml of 50% HCl acid preservative

Cortisol

nmol/L

Serum or plasma 150- 700

Serum preferred. Collect between 0800 and 0900. Ensure date & time of collection are recorded.

Cortisol (urine)

nmol/day

Urine < 900

24 hour urine. No preservative.

Creatine Kinase (CK)

Plasma or Serum

	Vitros	U/L	QEII MC
0d-2m	30-450	0d-5d	<700
3m-11m	25-220	6d-6m	<300
1y-10y	25-175	7m-3y	<200
11y-15y	30-170	4y-6y	<150
>=16y Male	30-170	7y-17y Male	<250
>=16y Female	30-140	7y-17y Female	<150

Plasma preferred. cTroponin T should be requested separately on the form, if required.

Creatinine

Plasma or Serum

Age	QEII MC	µmol/L
0d-7d	<85	Vitros <100
8d-30d	<50	<65
31d-1y	<30	<35
1y-10y	<50	<65
11y-15y (M)	<75	<90
11y-15y (F)	<60	<75
>=16y (M)	60-120	70-135
>=16y (F)	50-95	60-105

Plasma preferred.

Creatinine (urine)

mmol/day

<i>Urine</i>	0d-2y	*****
	3y-8y	1.0-6.0
	9y-12y	2.0-13.0
	13y-17y	3.0-17.0
	>=18y Male	9.0-18.0
	>=18y Female	5.0-16.0

24hour collection. Add 20ml 50% Acetic Acid OR 20ml 50% HCl OR no preservative if concurrent with a request for test that must be collected without preservative.

Creatinine Clearance

Urine & Blood (plasma or serum)

	Age	Range	Unit
Uncorrected	>=0d	>1.30	mL/sec
Correct for surface area	0d-8y	>0.70	mL/sec/1.73sq m
	>=9y	1.24-2.08	mL/sec/1.73sq m

24hr Urine (20 mls of 50% Acetic Acid OR no preservative) + Plasma or Serum. Please record patient height & weight.

Crossmatch

EDTA (whole blood)

10mls EDTA (whole blood). The specimen label MUST be signed by the collector or it will be rejected for testing.

Crossmatch - B Cells

*

See: HLA Crossmatch (T & B Cells)

Crossmatch - T Cells

*

See: HLA Crossmatch (T & B Cells)

Cryoglobulins

Local Units

Serum x 2

0

20 mls clotted blood preferably fasting. Prewarm needle, syringe, tubes etc to 37°C. Collect, allow to clot, & transport at approx 37°C. There must be at least 4 ml of serum. Indicate on request form that correct procedure was used. NB: Use thermometer to measure temperature. Do not estimate! Collect samples Monday to Friday ONLY (before 1600). Deliver to lab with minimal delay. Quantitation (cgld) and immunofixation electrophoresis performed if cryoglobulin detected qualitatively (cgld).

CSF Glucose

mmol/L

CSF

2.7 - 4.4

More than 0.2ml in Fluoride oxalate tube.

CSF Oligoclonal Bands

*

See: Oligoclonal Bands.

CSF Protein

CSF		QEII MC	g/L	
				Vitros
	0-d	0.40-1.20	0-7d	0.30-1.10
	2d-30d	0.20-0.80	8d-30d	0.30-1.00
	>=1m	0.15-0.45	1m	0.25-0.80
			2m	0.15-0.60
			3m-5m	0.10-0.45
			6m-9y	0.10 - 0.35
			10y-15y	0.10 - 0.45
			>=16y	0.12 - 0.60

Cyclin D1 Over-expression

Blood or bone marrow

Collection Volume:

10ml blood; 5ml bone marrow.

Minimum Collection Volume:

5ml blood; 2ml bone marrow.

Collection:

Blood: Collect in purple top (EDTA) tube; alternate container yellow top ACD tube.

Bone marrow: Collect aspirate into EDTA.

NOTE: The use of heparin anticoagulant may inhibit PCR.

Store at room temperature. Deliver to the laboratory without delay. Transport at room temperature; protect from temperature extremes. Do not use ice bricks in the transport container.

Must arrive within 24 hours of collection.

Cyclosporin A

EDTA (whole blood)

	ug/L	
TYPE	3-6 months (ug/L)	Over 6 months (ug/L)
Kidney	100 - 250	80 - 200
Liver	150 - 300	100 - 200
Heart	250 - 400	150 - 225
Heart/Lung	350 - 600	200 - 300
Bone Marrow*	100 - 300	

* CSA therapy in bone marrow transplant is typically of short duration.

Samples for 'trough level' monitoring are collected immediately before a dose. Assays performed using CEDIA Monoclonal assay.

Cyclosporin C2

EDTA (whole blood)

	ug/L						
TYPE	0-1m	1-2m	2-3m	3-6m	6-12m	Over 12m	
Kidney	>=1,700	1,500	1,300	1,100	900	800	
Liver	1,000	1,000	1,000	800	600	600	

Samples for 'C2' monitoring are collected at 2 hours (+/- 15 mins) after a dose.

Cysticercosis Serology

Serum

D-Dimer Quantitative (QEII MC)

Citrate

	mg/L
< 0.5	

Citrate tubes must be filled to mark.

Dehydroepiandrosterone Sulphate (DHEA)

μmol/L

Serum or Plasma

0-7d	2.0-12.0	
8d-30d	0.8-8.0	
1m-6y	<2.0	
7y-8y	<3.0	
9y-10y	<4.0	
Tanner Stage; 11y-16y:		
	Males	Females
1	<4.0	<4.0
2	<5.0	<7.0
3	<8.0	<9.0
4	0.9-10.0	1.0-11.0
5	0.9-11.7	2.2-15.2
18-30y	1.2-10.3	3.4-16.7
31-50y	0.8-10.2	1.6-12.2
51-60y		0.5-11.1
61-83y		0.3-7.7
Post menopausal		0.8-7.0

Deoxypyridinoline*Urine*

No longer performed. Test replaced by N-Telopeptide Calculated ratio.

Desipramine

µg/L

Serum or Plasma (no gel tubes) 150 - 500

Sample at least 12 hours post dose. Minimum 2 mL of serum or plasma.

Dexamethasone Suppression Test (High Dose)

nmol/L

Serum or Plasma

Contact duty biochemist or biochemistry registrar for details 9346 1511.

Dexamethasone Suppression Test (Overnight)

nmol/L

Serum or Plasma < 100

Give 1mg oral dexamethasone phosphate in the evening (between 2300 and 2400). Next morning collect blood for cortisol levels (0800 - 0900). Serum preferred. Dexamethasone supplied by Hospital Pharmacy Department.

DHEA

*

See: Dehydroepiandrosterone Sulphate (DHEA)

Digoxin

µg/L

Serum or Plasma (no gel tubes) 0.5 - 0.8

Sample 8 - 24 hours after last dose to avoid prolonged distribution phase. Note: the historical upper limit of 2 µg/L was based on the prevention of clinical toxicity. Concentrations >1.2 µg/L have been associated with significant increased mortality.

Dilantin

*

See: Phenytoin

DNA Studies for Thalassaemia*EDTA whole blood x 2***Donath-Landsteiner Test***10 ml Clot*

Negative

By consultation with Haematologist (2890). Sample must be collected and maintained at 37°C. Deliver to lab immediately.

Dothiepin / Desmethyldothiepin

µg/L

Serum or Plasma (no gel tubes)

10 - 200 for Dothiepin

Sample at least 12 hours post dose. If dose changed, reassay after about 2 weeks. Minimum 2 mL of serum or plasma.

Doxepin / Desmethyldoxepin

µg/L

Serum or Plasma (no gel tubes)

125 - 250 µg/l for Doxepin plus Desmethyldoxepin.

Sample at least 12 hours post dose. If dose changed, reassay after about 2 weeks. Minimum 2 mL of serum or plasma.

Drug Screen (Drugs of Abuse)

*

See: Narcotic Screen.

Drug Screen (Mini)

Serum or Plasma (no gel tubes)

Test no longer performed.

Recommend acute testing for only alcohol and paracetamol in overdose.

Electrophoresis Protein (Blood)

Serum

Serum only, plasma unsuitable. Primary use is to screen for myeloma. Paraproteins can not be excluded unless both serum and urine are analysed.

Electrophoresis Protein (Urine)

g/day

Urine (24hr or spot urine) 0.02 - 0.15

24hr urine or spot urine (minimum of 25 mls) without preservative. Collect a separate yellow top container for testing. Paraproteins can not be excluded unless both serum and urine are analysed.

Erythrocyte Sedimentation Rate

Citrate ESR Tube

Require whole blood in Sedisystem tube. (Fill to maximum). Must be tested within 24 hours of collection.

Estimated Glomerular Filtration Rate*Plasma or Serum*

>17y >60

mL/min/1.7

3m2

Plasma preferred.

Estimation of GFR (eGFR) is by MDRD formula and is based on plasma creatinine, sex and age of the patient ONLY. eGFR is only applicable to patients in a stable medical condition. The calculation does not apply to patients on dialysis or patients of extreme age or body mass and has only been validated in caucasians.

Factor Studies

*

See: Coagulation Factors

Factor V Leiden*EDTA*

Homozygote, Heterozygote or Normal

Transport at room temp. Also performed as part of Thrombophilia screen

Faecal Fat (3 days)

*

No longer performed. See: Faecal Pancreatic Elastase.

Faecal Pancreatic Elastase*Faeces*

One single stool - yellow top container. Sample to be kept chilled.

Farmer's Lung

*

See: *Micropolyspora faeni*.

Fasting Metabolic Bone Study*Blood and urine*

FOR PATIENTS ATTENDING SIR CHARLES GAIRDNER HOSPITAL

Please bring your request form and this instruction sheet with you to either:

Specimen Collection, E Block between 8.00 am and 11.00 am Monday, Wednesday or Thursday.

Specimen Collection, PathWest QEII MC Reception, J Block between 8.00 am and 11.00 am Monday to Friday

FOR PATIENTS NOT ATTENDING SIR CHARLES GAIRDNER HOSPITAL

See back of request form for Collection Centres. Please check if appointment for collection is needed.

Please bring your request form and this instruction with you.

1. On the NIGHT BEFORE THE TEST:

DO NOT EAT ANYTHING AFTER 10pm.

You must REMAIN FASTING until the completion of the test the next morning.

YOU MAY DRINK AS MUCH WATER AS YOU WANT TO.

2. On the MORNING OF THE TEST:

EMPTY YOUR BLADDER on rising.

HAVE NOTHING TO EAT OR SMOKE.

DO NOT TAKE ANY MEDICATION UNTIL AFTER THE TEST.

DRINK WATER IF YOU ARE THIRSTY.

DO NOT DRINK tea, coffee or milk.

3. Before leaving home, YOU MAY EMPTY YOUR BLADDER IF NECESSARY.

4. YOUR TEST will involve both, a blood sample and a urine sample.

INSTRUCTIONS TO COLLECTORS:

1. Collect urine - Spot urine samples for FMBS must be collected in 60 ml containers without acid preservatives
2. Fill one heparinised vacutainer (plasma) for routine biochemistry.
3. Fill one clot tube for ionised calcium. Avoid venous occlusion during collection by releasing tourniquet ASAP. Collect blood into a clotted tube (vacutainer is acceptable). Centrifuge the blood and separate the serum into a container with a screw cap (the recommended container is the Hepatitis C tube - cross out the PCR label). The container must be filled with serum to within 0.5 cm from the top. Do not overfill. Keep the specimen refrigerated. The specimen should be analysed within 24 hours of collection.
4. Fill one full gel EDTA vacutainer (plasma) for parathyroid hormone (PTH).
5. Send all samples with request form(s) to PathWest Laboratory Medicine WA, QEII MC CRA.

TRANSPORT OF SPECIMEN:

All samples should be centrifuged and kept chilled (Do not freeze). If there is a delay (>6 hours) in transport, heparin tube should be centrifuged and the plasma separated from the cells. **DO NOT** pour off EDTA plasma.

*** Be aware that the collections requirements for the 'IAB' Study/Clinical trial are NOT the same. The instructions provided with the request must be followed.

FMBS TEST INCLUDES:

Blood- Total Calcium, Ionised Calcium, Phosphate, Albumin, Creatinine, GGT, PTH, Vitamin D and ALP.
Urine- Calcium, Phosphate, N-Telopeptide and Creatinine for Urine.

FBP or FBC

*

See: Full Blood Count (Examination)

Ferritin		$\mu\text{g/L}$
<i>Serum or Plasma</i>	<6 m	6 - 410
	6 m - 2 yr	6 - 80
	2 yr - 15 yr	10 - 60
	Adults: Female - premenopausal	20 - 220
	- post menopausal	30 - 370
	Male	30 - 620

Plasma preferred.

Feto-Maternal Haemorrhage Test (FMH)

EDTA whole blood

The specimen tube label MUST be signed by the collector or it will be rejected for testing. FMH test is only suitable for Rh(D) Negative mothers with known Rh(D) Positive baby. Otherwise a Kleihauer test must be performed. See Kleihauer test.

Fibrinogen

Citrate x 1 2 - 4

Citrate tubes must be filled to mark.

FK506/Tacrolimus

EDTA whole blood 5.0-20.0

Collect 5 ml EDTA blood. Sample preferably in the morning at least 12 hr after previous dose or just before next dose.

Flecainide

mg/L

Serum or EDTA Plasma (no gel tubes) 0.2 - 1.0

Sample just before next dose. If toxicity suspected - sample at peak (2-3 hrs) or when symptoms are present. Minimum 5 mL of serum or plasma. Separate and transport frozen.

Flow Cytometry*Various*

Testing should be done within 48 hrs of collection. BLOOD OR BONE MARROW (in EDTA) Maintain and transport at room temperature. A method used to enumerate specific cell types (eg T cells, T helper cells). See: Lymphocyte Subsets.

TISSUE OR BODY FLUID SAMPLES

See: Lymph Node for Flow Cytometry for tissue sample requirements .

Consult haematologist if testing required on samples other than blood or bone marrow.

Fluoxetine / Norfluoxetine

µmol/L

Serum or Heparinised Plasma (no gel tubes) 0.03 - 1.37 for fluoxetine

Trough level is taken before next dose. Minimum 2 mL of serum or plasma. Separate and transport chilled.

Folic Acid (Red Cell)

nmol/L

EDTA whole blood 230 - 1600

Folic Acid (Serum)

nmol/L

Serum ONLY

7.0-40.0

Send to Lab with minimal delay.

Follicle Stimulating Hormone (FSH)

U/L

Serum or Plasma

0-7d

<4

8d-14d

<2

15d-11y Male

<4

15d-11y Female

<6

>=12y Male

1-8

>=12y Female:

Follicular & Luteal

2-10

Post Menopausal

>18

Serum preferred.

Free Androgen Index (FAI)*Serum or Plasma*

Female: 1 - 7

Serum preferred. Only reported for female, not appropriate for male. If requested on male do Testosterone and Sex Hormone Binding Globulin (SHBG).

Free PSA*Serum or Plasma*

Ratio: <0.10 - Higher risk of cancer

> 0.25 - Lower risk of cancer

0.10 - 0.25 - Indeterminate

Serum preferred.

Free T3

*

See: Triiodothyronine (Free T3)

Free Testosterone

pmol/L

Serum or Heparin Plasma 260-750

Serum preferred. Minimum volume of 200uL. For male patients only (for females request FAI).

Free Testosterone (Calculated) for Male patients is now available using Testosterone and SHBG and patient age (years). Please note female testosterone requested as FAI.

Free Thyroxine (FT4)

*

See: Thyroxine

Fructosamine

umol/L

Serum or Heparinised plasma 205-285

FTA (antibodies)

*

See: Syphilis Serology

Full Blood Count (Examination)

EDTA whole blood

(See Page 137 and 138 of the 2007 PathWest Laboratory Medicine WA Reference Intervals Manual for the Reference Intervals)

Gabapentin

Serum or Plasma (no gel tubes)

Sample just prior to next dose. Therapeutic benefit is evident at plasma levels >2mg/L. Minimum 2 mL of serum or plasma.

Gamma Glutamyl Transferase

U/L

Plasma or Serum

0 - 30d	<150
1m-3m	<125
4m-6m	<100
7m-11m	<50
1y-6y	<20
7y-11y	<25
12y-15y Male	<35
>=16y Male	<60
12y-15y Female	<25
>=16y Female	<40

Plasma preferred.

Gentamicin

Serum or Plasma (no gel tubes)

For patients with normal renal function, once daily dosing is the method of choice. Collect specimen between 6 and 14 hours after last dose. Result should lie between the upper and lower lines. For assistance with interpretation, dosing or special populations contact Dr C Golledge 9346 3625 or the SCGH Drug Information Service 9346 2987. For IV therapy: collect peak dose 30 minutes after dose is given. Oral therapy: Collect peak dose 60 minutes after dose is given. (See Page 139 of the 2007 PathWest Laboratory Medicine WA Reference Intervals Manual for the Reference Intervals)

Gestational Diabetes Mellitus Screen

*

See: Glucose Challenge Test (Pregnancy 26-28 weeks)

Gestational Glucose

*

See: Glucose Challenge Test (Pregnancy 26-28 weeks)

Glucose (Blood)

mmol/L

<i>Fluoride Oxalate plasma</i>	0d-2d	2.6-5.4
	3d-12y	3.0-5.4
	>=13y	3.0-5.4

Glucose (CSF)

*

See: CSF Glucose.

Glucose Challenge Test (Pregnancy 26-28 weeks)

Fluoride Oxalate plasma

Non fasting. Give patient 50gm or 75gm of Glucose drink, collect sample 1hr (60 mins) post glucose load.

Record glucose load given on request form.

Screening for gestational diabetes. 26 - 28 weeks (non-fasting).

After 50g load - Positive test after 1 hour: ≥ 7.8 mmol/L

After 75g load - Positive test after 1 hour: ≥ 8.0 mmol/L

Confirm diagnosis after positive screening test with a fasting 75g Glucose Tolerance Test

Gestational diabetes mellitus: if glucose at 0 hour ≥ 5.5 mmol/L and/or glucose 2 hours ≥ 8.0 mmol/L

Glucose Tolerance Test*Fluoride Oxalate x 3*

		mmol/L
	Fasting	2 hr
Normal	<=6.0	< 7.8 mmol/L
Impaired	<7.0	and 7.8-11.0 mmol/L
Diabetic	>=7.0	and/or >11.1 mmol/L
Pregnancy diabetic	>=5.5	and/or >=8.0 mmol/L

Refer to PCSP006 document for collection details.

ADULT

Collect fasting blood specimen. Give 75g glucose orally and collect blood samples after 1 hour and 2 hours. (Test unnecessary if fasting glucose >= 7.0 mmol/L on two occasions.)

CHILD

Proceed as for Adult, but the glucose dose needs to be calculated on the basis of 1.75 gm glucose per Kg of body weight, up to a maximum of 75 gm glucose. If the patient vomits 1 hour after the glucose drink, proceed with the test and collect the blood samples at the required times. Mark on the request form the approximate time when the patient vomited. If unsure, please contact the Duty Biochemist.

NB: Occasionally insulins may be requested as part of a glucose tolerance test. Collect serum samples at 0, 1 hour and 2 hours. Not to be performed on "In Patients" unless permission has been obtained from the Duty Biochemist.

Glucose-6-Phosphate Dehydrogenase

U/g Hb

EDTA whole blood 7.0 - 17.0

1ml of EDTA blood is sufficient for newborns.

Glycated Haemoglobin

%

*EDTA or Heparin or Fluoride
oxalate (whole bloods)*

4.0-6.0

Normal: <6.0

Good control: 6.0 - 7.0

Acceptable control: 7.1 - 8.0

Poor control: >8.1

Prior to conception, a glycated haemoglobin <7.0% is advisable to reduce the incidence of birth defects.

Granulocyte Antibodies*EDTA whole blood.*

Test must be performed within 12 hours of collection. Contact details: John Lown 9224 2044

Group and Hold Serum*EDTA whole blood 10 mls*

Specimen labels MUST be signed by the collector or they will be rejected for testing.

Growth Hormone

mU/L

Serum (preferred) or Plasma < 10

A resting (baseline) sample to be taken if only growth hormone is requested. Growth hormone <1.0 makes acromegaly unlikely. Growth hormone ≥ 1.0 does not exclude acromegaly. Suggest measurement of IGF 1 level. For the investigation of Acromegaly specimens for OGTT should be taken at 0, 30, 60, 90 and 120 mins. All samples to be analysed for glucose and growth hormone.

Haemochromatosis

EDTA or Heparin (whole bloods) Normal, Heterozygote or Homozygote

Send whole blood. EDTA preferred. Minimum of 5 mls. Maintain and transport at room temperature.

Haemoglobin (Hb)

EDTA whole blood

Part of FBC. See: Full Blood Count. Also can be done as a single test.

Haemoglobin Electrophoresis/HPLC

%

EDTA & Fresh Blood Film (Unstained) Normal

5mL EDTA sample required. Abnormal haemoglobins will be further investigated including DNA studies

Haemosiderin (Urine)

Urine Negative

Prefer early morning spot urine (yellow top)

Haptoglobin

g/L

Serum or Plasma 0.3-2.00

Hereditary Spherocytosis Screening Test

EDTA whole blood

Replaces Osmotic Fragility Test. 5ml EDTA (whole blood) required.

High Density Lipoprotein (HDL) Cholesterol

mmol/L

Plasma or Serum

0d-16y

0.9-2.0

>= 17y

>1.0

Plasma preferred.

HIV 1 and 2 Antibodies*Serum*

Request form must be signed by a doctor. Supplemental testing is performed if screening tests are reactive.

HIV Flow Cytometry*EDTA whole blood*

CD 4/8 Ratio - 1.0 to 3.5

CD4 Absolute - $500 \times 10^6/L$ Units: CD Counts - $10^6/L$ and as %Lymphocyte Count - $10^9/L$

Collect a separate EDTA whole blood for this assay. Measures T cell subsets (CD3, 4, 8, CD45RO and CD45RA) on HIV patients.

HIV Gene Sequencing (Protease)*EDTA plasma (x2) or ACD**plasma*

If requested with HIV Gene Sequencing (Reverse Transcriptase), 10ml total EDTA is adequate and the preferred specimen. Plasma to be separated within 6 hours of collection.

HIV Gene Sequencing (Reverse Transcriptase)

*EDTA plasma (x2) or ACD
plasma*

Performed only by consultation with RPH Immunology (9224 2899). If requested with HIV Gene Sequencing (Protease), 10ml total EDTA is adequate and the preferred specimen.

HIV Provirus DNA PCR

EDTA whole blood

HIV RNA (viral load)

EDTA plasma

Collect a separate 1 x 9-10 mL EDTA tube or 2 x 4mL EDTA for this assay. Collect at a minimum of 8ml EDTA blood and if separating, a minimum sample of 2.0 ml EDTA plasma is required.

HLA Antibodies

Serum

Negative

Do not confuse with HLA typing.*** Collect 10ml clot minimum *** Screening of patients on bone marrow, renal, cardiac and liver transplant programs and transfusion dependent patients. In the event of febrile transfusion reaction, collect recipient pre- and post- transfusion samples as well as the transfused donor blood is desirable.

HLA B27

10 ml ACD

Maintain and transport tubes at room temperature.

HLA Crossmatch (T & B Cells)

20ml ACD + 10ml clot

Transport the ACD tube at room temperature and transport the serum or clot sample chilled. DO NOT separate the ACD sample.

Performed for solid organ and bone marrow transplantation. Crossmatches are only pre-booked with the Transplantation Medical Scientist in Immunology at RPH. Booking is the responsibility of the appropriate Renal unit or requesting doctor. Pre booking is NOT the responsibility of the collection centre. For enquires on HLA Crossmatches, consult the Transplantation Medical Scientist in Immunology at RPH on (08) 9224 2899. For issues on timing of sample collection, the immunology Section at QE II may be consulted on (08) 9346 2906.

Collect samples Monday – Thursday and send same day if possible, to arrive at PathWest QE II Immunology ASAP after collection and before 1100 am on Friday. Country Laboratories DO NOT collect sample on Friday, Saturday or Sunday. Other collection centres and laboratories may collect on Friday morning if the sample can definitely be in the Immunology Section at the QEII by 11 am Friday. This assay should not be collected on Friday afternoons, Saturday or Sunday.

HLA Typing - Class I (ABC)

ACD

10ml blood into ACD. DO NOT separate. Collect samples Monday to Friday (before 1200 Fri). Deliver to lab with minimal delay. Urgent testing/results available by consultation with RPH Immunology (9224 2899). Tests done by DNA sequencing, serological typing also available by consultation (special collection and transport conditions may apply)

HLA Typing - Class II (DR-DQ by specific request)*ACD*

10 ml blood into ACD. DO NOT separate. Collect samples Monday to Friday (before 1200 Fri). Deliver to lab with minimal delay. Urgent testing/results available by consultation with RPH Immunology (9224 2899). Tests done by DNA sequencing, serological typing also available by consultation (special collection and transport conditions may apply)

Homocysteine (Homocystine)

µmol/L

Plasma

0-6m	4.0-13.0
7m-10y	3.0-8.0
11y-15y	4.0-10.0
16y-18y	4.0-11.0

Adult Male: 8.0 - 14.0

Adult Female: 6.0 - 12.0

URGENT! Plasma MUST be separated within 45 minutes of collection (prefer within 30 minutes). If estimated time of separation will take more than 45 minutes after collection, collect and keep whole blood on ice . Once separated, homocysteine is stable in plasma.

Homogentisic acid*Urine*

Qualitative test (POS or NEG result).

Fresh spot urine, minimum of 50 ml

Human Chorionic Gonadotrophin (HCG/UCG)

*

See: Beta-HCG (BHCG)

Hydatid Serology

*

See Hydatid Antibodies (HA)

IgA Anti-Endomysial Antibodies

*

Test no longer performed. See IgA Anti-tissue Transglutaminase

IgA Immunoglobulin (Quantitative)

g/L

Serum or Plasma

The age related range is given on the report.

IgE Immunoglobulin (Total)

kU/L

Serum or Plasma

1% non-atopic and 20% atopic subjects have IgE >280 kU/L

Serum is preferred.

IGF 1

*

See: Insulin Like Growth Factor 1

IgG Immunoglobulin (Quantitative)

g/L

Serum or Plasma

The age related range is given on the report.

IgG Subclasses

g/L

Serum

The age-related reference range is given on the report.
Usually indicated when total IgG or IgA is low. Contact Immunology
Consultant for further information.

IgM Immunoglobulin (Quantitative)

g/L

Serum or Plasma

The age related reference range is given on the report.

Imipramine

µg/L

Serum or Plasma (no gel tubes)

200 - 500 µg/l for the sum of imipramine plus desmethylimipramine

Collect 5 ml blood. Sample at least 12 hours after last dose. If dose changed, reassay after 2 weeks.

Immune Function Tests

*

Battery of tests. By consultation only contact IMMUNOLOGY Dept (2833).

Immunofixation Electrophoresis*Serum or Urine***Immunoglobulins***Serum or Plasma*

Includes IgA, IgG, IgM (Quantitative).

Immunophenotyping

*

See: Flow Cytometry / Lymph Node for Flow Cytometry for tissue sample requirements / Lymphocyte Subsets

Infectious Mononucleosis Screen*Serum or EDTA plasma*

Should be done in conjunction with FBC and Blood Film. Heparin plasma not suitable.

INR (International Normalised Ratio)

Citrate x 1 (Whole Blood) 0.8-1.3

To be received within 24 hours of collection. Citrate tubes must be filled to the mark. Do not separate, send as whole blood.

Insulin mU/L

Serum or Plasma < 12 (Fasting)

Serum preferred. Fasting sample. Simultaneous plasma glucose levels are required for interpretation

Insulin Like Growth Factor 1

Serum, heparin plasma

		µg/L	
AGE	RANGE	AGE	RANGE
0d-30d	11-41	16y	193-731
1m-12m	55-327	17y	163-584
1y	51-303	18y	141-483
2y	49-289	19y	127-424
3y	59-283	20y-24y	116-358
4y	50-286	25y-29y	117-329
5y	52-297	30y-34y	115-307
6y	57-316	35y-39y	109-284
7y	64-345	40y-44y	101-267
8y	74-388	45y-49y	94-252
9y	88-452	50y-54y	87-238
10y	111-551	55y-59y	81-225
11y	143-693	60y-64y	75-212
12y	183-850	65y-69y	69-200
13y	220-972	70y-74y	64-188
14y	237-996	75y-79y	59-177
15y	226-903	>=80y	55-166

Serum preferred. Avoid delays in transport to lab.

Intrinsic Factor Antibodies

*

See: Anti-Intrinsic Factor Antibodies.

Iron (Liver)*Liver biopsy*

Iron overload:
30 - 100 minimal
101 - 200 moderate
>200 severe

mmol/kg
dry weight

Biopsy into 75ml screw top container. NO formalin, saline or preservative.

Iron Studies*Serum or Heparin Plasma*

	Male	Female
Iron : umol/L		
Iron (0d-5y)	5-25	5-25
Iron (6y-16y)	7-25	7-25
Iron (>=17y)	9-30	9-30
Transferrin : umol/L		
Transferrin (0-11m)	12 - 36	12 - 36
Transferrin (>=12m)	23 - 43	23 - 46
Transferrin saturation (0-2y)	10-45	10-45
Transferrin saturation (3y-16y)	12-45	12-45
Transferrin saturation (>=17y)	14-53	13-48
Ferritin : ug/L		
0-30d	30-515	30-515
1m-6m	10-410	10-410
7m-11m	10-80	10-80
1y-5y	10-60	10-60
6y-15y	12-70	12-70
16y-49y	30-500	20-200
>=50y	30-500	30-300

Tests include Serum iron, Transferrin, Ferritin.

Heparin Plasma preferred.

Ketones

*

See: Acetoacetate.

Kleihauer test for Foetal Hb*EDTA*

See also: Feto-Maternal Haemorrhage test.

Lactate

mmol/L

Heparin, ABG or fluoride <1.5
oxalate

Suitable specimen types:

- 1) Blood gas sample, analysed within 15 minutes of collection.
- 2) Venous heparin whole blood specimen kept and transported on ice. To be hand delivered to CRA. Note collection and sample handling details on request form.
- 3) For remote collections where plasma separation is delayed. Collect blood into a Blood alcohol collection tube (contains 200mg NaF and 30 mg potassium oxalate) and mix gently by inversion . Separate plasma from cells within 2 hours. Lactate in plasma from blood alcohol tubes is stable refrigerated for at least 2 days. Separated plasma can be transported chilled. Blood alcohol tubes may be obtained from HCN Supply catalogue number 90420A.

Lactate Dehydrogenase

U/L

Serum or Plasma 125-250

Plasma preferred

Samples must not be haemolysed. Serum or plasma must be separated from cells within 6 hours of collection.

Lactose Tolerance Test

Fluoride oxalate x 5

Use fluoride oxalate tubes (grey cap). Dissolve 50g of lactose in 250ml of warm water, patient to take orally. Collect sample at fasting and 15, 30, 60, and 90 minutes post dose. Adequate response is peak plasma glucose increment greater than 1.7 mmol/L. If the test is abnormal, on another day, administer 50g of glucose to the fasting patient and collect sample at fasting and 15, 30, 60 and 90 minutes post dose for plasma glucose.

Lamotrigine

mg/L

Serum or Plasma (no gel tubes) 2 - 14

Sample blood just before next dose. Minimum 2 mL of serum or plasma.

Lead

µg/100mL

EDTA or Heparin (whole blood) Unexposed: <10 Blood

Occupational exposure

Acceptable: <30

Elevated: 40 - 60

Excessive: >60

Leishmaniasis

*

Contact Clinical Microbiologist 9346 3625. Serology has a Leishmania Donovanii Test available.

Lipase*Plasma or Serum*

		U/L
QEII MC:	0d-11m	<30
	1y-9y	<35
	10y-18y	<40
	>=19 y	<60
Vitros:	0d-11m	10-110
	12m-23m	10-130
	2y-14y	15-150
	15y-18y	15-180
	>=19 y	20-210

Plasma preferred.

Lipid Profile*Plasma or Serum*

		mmol/L
Total Cholesterol	<3 yr	1.2-4.5
	4 - 18 yr	2.8-4.5
	>18 yr	<5.5
HDL Cholesterol		>1.00
Triglyceride	0 - 9 yr	0.3-1.4
	10 - 18 yr	0.4-1.6
	>18 yr	<2.0
LDL Cholesterol	(low risk)	<3.0
	(high risk)	>4.0
Chol/HDL ratio:		
below average risk		<3.0
average risk		3.0 - 5.0
markedly increased risk		>9.0

Fasting sample. Plasma preferred. Consisting: Total Cholesterol, HDL Cholesterol, Triglyceride and LDL Cholesterol.

Lithium*Serum or EDTA Plasma
(serum preferred)*

Therapeutic range. 0.5 - 1.2

mmol/L

DO NOT collect blood in Lithium heparin tube. Collect before a.m. dose or at least 12 hours post dose.

Low Density Lipoprotein (LDL) Cholesterol

mmol/L

Plasma or Serum

2y-16y	<2.9	
≥17y	<3.0	Disirable limit
	<2.0	NHFA Target

Patient must be fasting. Plasma preferred. Result is calculated from Cholesterol, HDL and Triglycerides.

Low Molecular Weight Heparin

u/mL

Citrate x 1

0.6-1.0	(Twice daily administration)
1.0-2.0	(Once daily administration)

Also called Anti-Factor Xa activity.

Lupus Inhibitor (Anticoagulant) Tests*Citrate x 2 (4.5ml), Clot*

Reported as present, equivocal or absent.

Clot to be collected (minimum 2.5 mls) as well as Citrate (x2). Citrate tubes must be filled to the mark.

Luteinizing Hormone

U/L

Serum or Plasma

0-14d	<2
15d-11y	<4
≥12y (Male)	2-7
≥12y (Female):	
Follicular	2-10
Mid Cycle	15-80
Luteal	2-10

Serum preferred.

Lycopene

µmol/L

*Serum (preferred) or Plasma
(Heparin or EDTA)* 0.1 - 0.8

Protect from light. Wrap specimens in foil. Transport to lab with minimal delay.

Lymph Node for Flow Cytometry

Fresh Tissue in RPMI

RPMI is available from Flow cytometry section 9346 3524.

Lymphocyte Subsets

*EDTA (Blood or Bone Marrow
in EDTA)*

Adult reference ranges (Blood):

CD3 (T cell)	600 - 2400 x 10 ⁶ /L
CD4 (T helper cell)	500 - 1400 x 10 ⁶ /L
CD8 (T suppressor cell)	200 - 700 x 10 ⁶ /L
CD16/56 (NK cells)	100 - 400 x 10 ⁶ /L
CD19 (B cell)	40 - 500 x 10 ⁶ /L
CD4/CD8 ratio	1.00 - 3.20 x 10 ⁶ /L

Contact PathWest Laboratory Medicine WA, QEII MC Flow Cytometry laboratory on 9346 3524 for other reference ranges.

Min sample 1ml. DO NOT SEPARATE. Maintain and transport at room temperature. Sample must be analysed within 24hrs of collection. Routine testing is NOT performed on weekends. Contact Ext 3524 for urgent requests.

See: HIV Flow Cytometry for samples from HIV patients, or requested together with a HIV Viral Load.

Magnesium

mmol/L

Plasma or Serum

0-7d	0.60-1.00
>=8d	0.70-1.10
Pregnancy 12 wk	0.60-1.00
24 wk	0.60-0.80
36 wk	0.60-0.80

Plasma preferred.

Magnesium (Urine)

mmol/day

Urine

0d-16y	*****
>=17y	2.0-6.6

24 hr collection. Add 20ml 50% Acetic Acid OR 20ml 50% HCl

Malaria Parasites*EDTA (whole blood) and Films*

EDTA blood collected (preferably at the time of spiking temperature). Please provide relevant clinical history and details of treatment, including details of travel in malarial areas.

Mast Cell Tryptase

ug/L

Serum

<14

Blood samples to be collected within 3 hours of a non-fatal event occurring. Post, mortem, serum Mast Cell Tryptase may be stable for 72 hours or more.

Methadone

µg/L

Serum or Plasma (no gel tubes)

Levels > 200µg/l in treating opiate dependence.

Collect 5ml blood. Sample just before next dose. If dose changed, reassay after 1 week.

Methaemalbumin

*

No longer performed at PathWest Laboratory Medicine WA, QEII MC.

Methaemoglobin

%

Heparin whole blood

<1.5

Samples must be tested within one hour of sample collection. Please inform testing Laboratory (2525) before sending.

Methotrexate*Serum or Plasma (no gel tubes)*

Collect 5ml blood. Sampling times and results dependant on specific treatment schedule. Urgent test.

Specimen to be assayed immediately. Cancer Therapy - For a single bolus dose of methotrexate, potentially toxic concentration are:

24 hours after dose >5 umol/L

48 hours after dose >0.5 umol/L

72 hours after dose >0.05 umol/L

Microalbumin

*

See: Albumin (Urine)

Muramidase (Lysozyme)

mg/L

Serum 1.5-2.7

Must be separated and frozen within 2 hours of collection.

Narcotic Screen*Urine*

No preservative. It is important to note if patient taking medications containing codeine etc. e.g. cough suppressants, some compound analgesic tablets etc. Tests for alcohol, amphetamines, benzodiazepines, marijuana, opiates (contains codeine, heroin and morphine) and cocaine. Minimum volume 30 mL.

Neuron Specific Enolase

µg/L

<i>Serum</i>	0d-11m	<25.0
	1y-5y	<20.0
	6y-15y	<18.0
	>=16y	<12.5

Serum only. Plasma is UNSUITABLE. Sample must not be haemolyzed.

Neutrophil Alkaline Phosphatase*EDTA/Blood films* 15 - 100

EDTA blood to lab within 30 minutes. Lab must be notified of collection and dispatch in advance.

Nortriptyline

*

See: Amitriptyline/Nortriptyline.

Oestradiol (E2)

pmol/L

Serum or Plasma

0-14d	<100
15d-10y	<50
11y-12y Male	<100
13y-15y Male	<250
>=16y Male	<100
11y Female	<150
>=12y Female:	
Follicular	110 - 450
Mid Cycle	550 - 1300
Luteal	350 - 800
Post menopausal	40-130

Serum preferred.

Olanzapine

µg/l

Plasma or Serum (no gel tubes)

Trough levels > 10

Minimum 2 mL of serum or plasma. Sample just before next dose.

Oligoclonal Bands

Must have BOTH CSF &
Serum sample

Positive/Negative

1ml (or 20 drops) CSF in a yellow top tube plus 1ml serum or plasma (collected concurrently with CSF).

Osmolality

mmol/kg

Plasma or Serum

0-30d

275-300

>=1m

275-295

Plasma preferred.

Osmolality (urine)

mmol/kg

Urine (spot)

0-30d

75-300

>=1m

50-1200

No preservative.

Osmotic Fragility

*

No longer performed. See: Hereditary Spherocytosis Screening test.

P24 Antigen

pg/mL

Serum

< 20

1 Plain clotted tube minimum.

Paracetamol

mg/L

Plasma or Serum (no gel tubes)

Values obtain < 4 hours are unreliable due to continuing absorption.
Toxicity @ >100mg/L 4 hours post ingestion.

Ideally the first sample should be 4 hrs after ingestion. Treat as an URGENT sample.

Paragonimus

Serum

Available through interstate contacts: Paragonimus CFT. Results entered in ULTRA by Serology (PathWest Laboratory Medicine WA QEII MC)

Parathyroid Hormone

pmol/L

Gel EDTA plasma (full)

0.9 - 9.0

To lab ASAP. (within 1 hr of collection)

Paroxysmal Nocturnal Haemoglobinuria Test

EDTA whole blood

Replaces Ham's Acid Serum Test. Tests for expression of CD55 & CD59.

pCO₂

*

See: Blood Gases

Perhexiline

µg/L

Serum or Plasma (no gel tubes)

150 -600

Collect 5ml blood. Sample just before next dose.

Pethidine / Norpethidine

*

No longer performed.
Not available in Australia.

PFA100

Minutes

Citrate x 2

Refer to 'PLATELET AGGREGATION' for specimen processing details.

pH (Blood)

*

See: Blood Gases

Phenobarbitone

mg/L

Serum or Plasma (no gel tubes) 15.0-25.0

Sample just before next dose. If dose changed, reassay after not less than 2 weeks

Phenytoin

mg/L

Plasma or Serum (no gel tubes) 10-20

Sample just before next dose. If dose changed, reassay after 5 to 7 days.

Phenytoin (Free)

mg/L

Serum or Plasma (no gel tubes) 1.0-2.0

Measures free concentration for patients with low albumin levels. Binding of phenytoin to serum proteins may decrease in conditions associated with hypoalbuminaemia.

Phosphate

mmol/L

Plasma or Serum

0-14d	1.70-3.00
15d-23m	1.30-2.30
2y-16y	1.10-1.80
>=17 yr	0.80-1.50

Plasma preferred.

Phosphate (Urine)

mmol/day

Urine

0d-16y	*****
>=17y	10.0-42.0

24 hr urine. Add 20ml 50% Acetic Acid or 20ml 50% HCl as a preservative.

Plasma Fluorescence Scan

Negative or Positive

Heparin or EDTA (whole bloods) Negative

Whole blood required 0.5 mL Protect from light.

Plasma Methyl Malonic Acid*Heparin Plasma or Serum*

Methyl Malonic Acid can be part of a Metabolic Screen. However, perform Plasma Methyl Malonic Acid if specifically requested. Minimum volume of 0.1 mL is required for paediatric samples. Separate and freeze sample if there's a delay in transport.

Plasma Viscosity

*

See: Viscosity (plasma)

Platelet Aggregation*Citrate x 2*

	%
Good aggregation:	65 - 100
Moderate aggregation:	25 - 64
Poor aggregation:	0 - 24

Citrate tubes must be filled to mark. To lab within 4hrs. Please ring PathWest Laboratory Medicine WA, QEII MC Coagulation laboratory (ext 1370) prior to collection of sample. Test available MON - FRI only.

Platelet Antibodies (Direct and Indirect)*Serum x 1 and Citrate x 2*

Maintain and transport at Room Temp.

PML-RAR A t(15;17)

Blood or bone marrow

Collection Volume:

10ml blood; 5ml bone marrow.

Minimum Collection Volume:

5ml blood; 2ml bone marrow.

Collection:

Blood: Collect in purple top (EDTA) tube; alternate container yellow top ACD tube.

Bone marrow: Collect aspirate into EDTA.

NOTE: The use of heparin anticoagulant may inhibit PCR.

Store at room temperature. Deliver to the laboratory without delay. Transport at room temperature; protect from temperature extremes. Do not use ice bricks in the transport container.

Must arrive within 24 hours of collection.

pO2

*

See: Blood Gases

Porphobilinogen

Urine (fresh)

Screening test. Urine must reach testing laboratory in 24 hours. Protect from light. Always done together with urine porphyrins.

Porphyrins (RBC)*2 Heparin or 2 EDTA (whole bloods)*

< 1.5

µmol/L
RBC

For porphyrin studies send blood, and urine. Protect from light.

Porphyrins (Urine)*Urine*

< 35

nmol/mmol
creatinine

Spot urine without preservative. For porphyrin screen send blood, and urine. Protect from light.

Potassium*Plasma*

0d - 7d	3.2-6.0
8d - 30d	3.4-6.0
1m - 5m	3.4-5.6
6m-11m	3.4-5.1
1y-12y	3.4-5.0
>=13y	3.4-5.0

mmol/L

Avoid haemolysis by minimising trauma during specimen collection.

Potassium (Urine - 24hr)*24 hr Urine*

>=17y 25-100

mmol/d

24 hr collection. Add 20 mls of 50% Acetic Acid OR 20 mls of 50% HCl or no preservative

Procoagulant Screen

*

See: Thrombophilia Screen

Progesterone

nmol/L

<i>Serum or Plasma</i>	0-7d	<10
	8d-11y	<5
	>=12y Female:	
	Follicular Phase	<2
	Luteal Phase	<4
	Mid-Luteal Phase:	
	Ovulation unlikely	<10
	Intermediate	10-30
	Ovulation likely	>30

Serum preferred.

Prolactin

mU/L

<i>Serum or Plasma</i>	0-14d	<5000
	15d-3y	<1500
	>=4y Male	<340
	>=4y Female	<420

Serum preferred. Rest (sitting) patient 30 minutes prior to specimen collection.

Prostate Specific Antigen

µg/L

<i>Serum or Plasma</i>	40y-49y	<2.5
	50y-59y	<3.5
	60y-69y	<4.1
	70y-79y	<6.1

Serum preferred.

Protein (24hr urine)

		g/day
<i>Urine</i>	0d-30 d	<0.07
	1m-23m	<0.09
	2y-4y	<0.12
	>=5y	<0.15
	Pregnancy	<0.30

24 hr urine. No preservative.

Protein (CSF)

*

See: CSF Protein

Protein (Total)

Plasma or Serum

		g/L
		Nedlands
		Vitros
	0d-30d	50-70
	1m-11m	55-75
	1y-3y	58-78
	>=4 y	60-80
	Pregnancy 12 wk	55-75
	24 wk	53-66
	36 wk	49-67

Plasma preferred.

Protein C/Protein S

%

Citrate x 2

Functional assay 70 - 150 %
 Immune assay 70 - 150 %

Protein C & S may be low if patient is receiving Anti-Vitamin K drugs (eg Warfarin). Recommend testing after cessation of anticoagulant therapy.

Also performed as part of Thrombophilia screen

Protein/Creatinine Ratio (Urine)

mg/mmol

Spot urine

0d-1y <55
 2y-15y <20
 >=16y <13
 Pregnancy <25

Prothrombin Gene Mutation

EDTA whole blood

Heterozygote or Normal

No need to send a separate EDTA if Factor V Leiden has also been requested.

Prothrombin Time (PT)

seconds

*

See: INR (International Normalised Ratio)

Pyridinolines

*

See: Deoxypyridinoline.

Pyruvate Kinase

EDTA whole blood

No longer available in WA. West Mead Children's Hospital in Sydney, NSW will only be offering the test after consultation with the Haematologist at the West Mead Children's Hospital. The requesting physician must contact the on call Haematologist at the West Mead Children's Hospital on (02) 9845 0000 prior to requesting the test.

Quantiferon

* % Specific Response

Needs URGENT attention. Mycobacteria response measured by interferon gamma quantitation. This test replaces Mycobacterium skin testing. Tests for Mycobacterium tuberculosis infection. The TB specific antigens CFP-10, ESAT-6 and TB7.7, and mitogen have been dried onto the inner wall of the TB antigen and mitogen blood collection tubes respectively.

Collection:

It is essential that the contents of the tubes be thoroughly mixed with the blood.

Collect samples directly into:

Cellestis Nil Antigen (grey cap)

Cellestis Mitogen (purple cap)

Cellestis TB Antigen (red cap)

Ensure that the correct volume is drawn into each of the tubes. Mix the tube well for 5 seconds to ensure that the entire inner surface of the tube has been coated with blood. If a butterfly needle is used for collection a 'blank' tube should be used prior to collecting into the 3 Quantiferon tubes.

These special tubes are available from Branch Administration.

Processing:

Do not refrigerate or freeze the blood samples. The tubes must be transferred to a 37-degree Celsius incubator as soon as possible and within 16 hours of collection. If a 37-degree Celsius incubator is available, incubate the tubes UPRIGHT for 16 to 24 hours. After incubation the tubes can be centrifuged for 15 minutes at 2000 to 3000 RCF (g) or alternatively may be held at 2 degree Celsius to 27 degree Celsius for up to 3 days prior to centrifugation. After centrifugation, remove at least 200uL of plasma and transfer to an appropriately labelled tube (prefer Sarstedt or Eppendorf tube if available). The plasma may be kept for up to 28 days at 2 degree

Celsius to 8 degree Celsius.

After centrifugation CLEARLY INDICATE on the tube AND on the request form if the blood tubes have been incubated at the collection or dispatch site.

As the time after collection and before incubation at 37 degree Celsius is flexible (within 16 hours), and the time after incubation and before centrifugation is flexible (up to 3 days at 2 degree Celsius to 27 degree Celsius), and the sample may be kept at 2 degree Celsius to 8 degree Celsius for up to 28 days before testing, the sample should be taken at all labs and collection centres at most times.

Note:

Collection by using the previous method (ie Heparin Whole Blood) is still acceptable however, samples should be received by PathWest QEII Immunology by 1600 and within 12 hours of collection and this service is not available on Friday. Samples that arrive on Friday and after hours (including weekends) are not tested without prior arrangement with the Clinical Immunologist or Senior Scientist at RPH, Immunology 9224 2899. Specimen to be packed in a separate esky, marked 'URGENT'.

Quantitative PCR for BCR-abl major breakpoints

Blood or bone marrow

Collection Volume:

20ml blood; 5ml bone marrow.

Minimum Collection Volume:

5ml blood; 2ml bone marrow.

Collection:

Blood: Collect in purple top (EDTA) tube; alternate container yellow top ACD tube.

Bone marrow: Collect aspirate into EDTA.

NOTE: The use of heparin anticoagulant may inhibit PCR.

Store at room temperature. Deliver to the laboratory without delay. Transport at room temperature; protect from temperature extremes. Do not use ice bricks in the transport container.

Must arrive within 24 hours of collection.

Quinidine

No longer performed. Not available in Australia.

Quinine

mg/L

Serum or Plasma (no gel tubes)

Consult laboratory for interpretation of results (08) 9346 2194

Rabies Immunity Testing

Serum

RAST

kU/L

Serum

Negative	<0.35
Low	0.35-0.69
Moderate	0.70-3.50
High	3.50-17.50
Very High	>17.50

Red Cell Enzyme Assay

*

See: Glucose-6-Phosphate dehydrogenase.

Red Cell Folate

*

See: Folic Acid (Red Cell)

Reticulocyte (Retic) Count*EDTA whole blood*

%	0.2 - 2.0
Absolute	20-130 x10 ⁹ /L

Specimens must be <24 hours old at time of assay

Rheumatoid Factor

kU/L

Serum or Plasma

<21

Sample must NOT be frozen

Risperidone

Serum or plasma (no gel tubes)

No range available.
Compliance testing only.

Collect 10ml blood. Sample just before next dose.

Salicylate

mg/L

Serum or Plasma (no gel tubes)

140-350

Sample just before next dose. If toxicity suspected sample when symptoms are present. If dose changed, reassay after 1 to 2 weeks.

Schilling Test

*

Test no longer available. Perform Anti-Intrinsic Factor Antibodies and Anti-Parietal Cell Antibodies instead.

Sertraline

*

No longer performed.
Not available in Australia.

Sex Hormone Binding Globulin

nmol/L

Serum or Plasma

<16 years	40 - 90
Male	10 - 50
Female	30 - 90

Serum preferred.

Skin Tests for Immunology

*

By consultation. Contact Immunology Clinic for advice 9346 3691.

Sodium

mmol/L

Plasma or Serum

0d-7d	133-146
8d-30d	134-144
1m-12y	134-143
>=13y	134-146

Plasma preferred.

Sodium (Urine 24hr)

mmol/d

24 hr Urine

>=17y	40-210
-------	--------

24 hr specimen preserved with 20ml of 50% acetic acid OR 20 ml of 50% HCl if concurrent with request for tests that must be collected in these preervatives.

Streptococcal Serology*Serum or Heparin Plasma*

Anti-DNAse B	<187 IU/mL
Anti-Streptolysin O	<200 IU/mL

Minimum volume 0.5ml serum. Serum preferred.

Sulphamethoxazole

mg/L

Serum or EDTA Plasma (no gel tubes)

Peak: 100 - 150

Serum preferred (no gel tubes). Collect at least 5ml blood. Sample at 2 hours post-dose. Separate and Freeze, transport frozen.

Synacthen Stimulation Test

nmol/L

Serum or plasma x 3

A cortisol concentration >550nmol/L at 30 min after synacthen injection indicates an adequate response.

If the patient is on steroid treatment, steroids must be stopped for 24 hours before the test. Take blood (0 time), then Medical staff to give 250µg Synacthen intramuscularly. Take samples after 30 minutes and 60 minutes. A Medical Officer should be in attendance to monitor anaphylactic reactions. Serum preferred. Refer also to package insert. The Synacthen is supplied by the Hospital pharmacy dept.

Syphilis Serology

Plasma (EDTA, citrate, heparin), Serum or CSF

Tests performed are :-

- Rapid Plasma Reagin Test (RPR)
- CSF - VDRL Test
- Murex ICE
- Fluorescent Treponemal Antibody Test (FTA(abs) IgG)
- IgM - capture EIA
- TPPA - Index

All incoming sera are screened with the Murex ICE test. (tpe) Quantitative RPR is performed on all Murex ICE positive sera. The RPR test is used to ascertain the currency of infection and response to treatment.

The CSF-VDRL is a reagin test designed for CSF samples from patients with possible neurosyphilis.

The Murex ICE detects *T. pallidum* specific IgG, IgA and IgM. Patients who have a positive Murex ICE Test for the first time also have a FTA(IgG) Test performed.

TPA Index Test. A test for neurosyphilis. A serum and CSF sample are required to be collected at the same time.

FTA(abs) IgG detects *T. pallidum* specific IgG.

The *T. pallidum* IgM-capture EIA is usually positive in primary Syphilis and congenital infection.

NOTE: Specimens arriving in laboratory before 0900 are tested and, in the case of negative results, are reported the same day. Positive results are reported by the following midday.

T Cell Subsets

*

See: Lymphocyte Subsets

Tansferrin Saturation

%

Serum or plasma

Males 14 - 53
Females 13 - 48

See also: Iron Studies

Testosterone

nmol/L

Serum or plasma

0-7d Male	2.0-14.0	0-30d Female	0.7-2.2
8d-20d Male	0.7-1.70	1m-5y Female	<0.4
21d-60d Male	2.0-14.0	6y-11y Female	<1.0
3m-5m Male	<6.1	>=12y Female	<3.2
6m-11m Male	<0.4		
1y-9y Male	<1.0		
10y-11y Male	<1.7		
12y-14y Male	0.4-20.0		
>=15y Male	10.0-35.0		

Serum preferred.

Tetrahydrocannabinoids (Cannabis)

*

See: Narcotic Screen.

Theophylline

mg/L

Serum or Plasma (no gel tubes) 10.0 - 20.0

Sample just before next dose. If toxicity suspected, sample at peak (1.5 - 3 hr) for normal preparations or at 4 - 6 hr for slow release formulations or when symptoms are present. If dose changed, reassay after 24 hrs.

Thiopentone

mg/L

Serum or Plasma (no gel tubes) No usual range but levels of 20 to 60 mg/L commonly seen when used in treatment of raised intracranial pressure.

Collect 5 ml blood.

Thrombin Time

seconds

Citrate x 1 17 - 20

Tubes must be filled to mark.

Thrombophilia Screen

Clot, Citrate x 3 and EDTA whole blood x 1

Include: Coagulation Profile, Antithrombin, Protein C, Protein S, Activated Protein C, Prothrombin Gene Mutation, Lupus Inhibitor (Anticoagulant) Tests. A Clot tube is to be collected (minimum 2.5 mls) as well as Citrate (x3). DO NOT spin Clot tube and EDTA, transport chilled. Centrifuge CITRATE for 30 mins at 3500rpm. Separate plasma into its own container (DO NOT POOL). Freeze citrate plasma within 1hr of collection, transport frozen (dry ice). Coagulation profile is routinely performed with the Thrombophilia screen at PathWest Laboratory Medicine WA, QEII MC, and will be reported if requested by doctor and Branch laboratory. The requesting doctor MUST indicate on the request form the specific tests required.

Thyroglobulin

Serum < 55 ug/L

Thyroid Function Tests (TFT)

Serum or Plasma

Measure Free Thyroxine and TSH

Thyroid Peroxidase Antibodies

*

See: Anti-Thyroid Peroxidase Antibodies

Thyroid Stimulating Hormone (TSH)

mU/L

Serum or Plasma

0-2d	0.20-25.00
3d-7d	0.20-15.00
8d-14d	0.20-10.00
15d-30d	0.20-8.00
1m-2m	0.20-7.50
3m-11m	0.30-6.00
1y-3y	0.40-4.50
>=4y	0.40-4.00

Adult Euthyroid 0.40 - 4.00

Thyroxine (Free T4)

pmol/L

Serum or Plasma

0-7d	13-40
8d-14d	11-31
15d-30d	11-27
>=1m	9-19

Serum preferred.

Tobramycin*Serum or plasma (no gel tubes)*

For patients with normal renal function, once daily dosing is the method of choice. Collect specimen between 6 and 14 hours after last dose. Result should lie between the upper and lower lines. For assistance with interpretation, dosing or special populations contact Dr C Golledge (08) 9346 3625 or the SCGH Drug Information Service (08) 9346 2923. For IV therapy: collect peak dose 30 minutes after dose is given. Oral therapy: Collect peak dose 60 minutes after dose is given. (See Page 139 of the 2007 PathWest Laboratory Medicine WA Reference Intervals Manual for the Reference Intervals)

Transferrin (blood)*Serum or Plasma*

Can also done on CSF (>2ml). See also: Iron Studies

Treponemal Serology

*

See: Syphilis Serology

Triglycerides

mmol/L

Plasma or Serum

0-9y	<1.5	
10y-16y	<1.7	
>= 17	<2.0	Desirable limit
	<1.5	NHFA Target

Patient must be fasting. Plasma preferred.

Triiodothyronine (Free T3)

pmol/L

Serum or Plasma

3.0-5.5

Serum preferred.

Troponin T (Cardiac)

*

See: Cardiac Troponin T (BRANCHES)

See: Cardiac Troponin T (QEII MC)

Trypanosoma Serology*Serum*

Screening tests for Chagas Disease (American trypanosomiasis) and African trypanosomiasis.

Tryptanol

*

See: Amitriptyline / Nortriptyline

Urate mmol/L*Plasma or Serum*

0 - 12 yr	0.10-0.30
>=13y Male)	0.20-0.42
13y-45y Female	0.14-0.36
>=46y Female	0.15-0.42
Pregnancy 12 wk	0.07-0.25
24 wk	0.11-0.25
36 wk	0.15-0.36

Plasma preferred.

Urate (Urine) mmol/d

<i>Urine</i>	Normal diet	<6.0
	Purine free diet	<3.6

24hr urine, No preservative

Urea mmol/L*Plasma or Serum*

	QEII MC	Vitros
0 - 7d	2.0-8.0	2.0-8.0
8d - 11m	1.0-6.0	1.0-6.0
1y - 3y	2.0-6.5	2.0-6.5
4y - 12y	2.5-6.5	2.5-6.5
>=13y Male	3.0-8.0	3.0-8.0
>=13y Female	3.0-8.0	2.5-7.0

Plasma preferred.

Viscosity (plasma)

mPa.sec

EDTA plasma x 4

This is not whole blood viscosity. Store and transport EDTA plasma chilled.

Vitamin A

µmol/L

*Serum (preferred) or Plasma
(Heparin or EDTA)*

0-6y	0.7-1.8
7y-12y	0.9-1.8
13y-19y	1.0-4.0

Protect from light. Wrap specimens in foil. Transport to lab with minimal delay.

Vitamin B12

pmol/L

Serum or plasma

120 - 680

Vitamin C

mg/L

EDTA plasma x 2

Normal: 4 - 14
Deficiency: <2.0

Deliver to laboratory (at room temperature) within one hour of collection. Protect from light. Do not collect on weekend or after hours. DO NOT SEPARATE.

Vitamin D

nmol/L

*Serum or plasma (Heparin or
EDTA)*

>50

To lab ASAP. Any delays, despatch chilled.

Vitamin E

μmol/L

<i>Serum (preferred) or Plasma (Heparin or EDTA)</i>	0-6y	7-30
	7y-12y	10-30
	13y-19y	13-30
	>=20y	18-46

Protect from light. Wrap specimen in foil. Transport to lab with minimal delay.

Warfarin

mg/L

Serum or Plasma (no gel tubes) 0.5 - 3 in long term therapy. (0.04 - 0.22 mg/kg/day).

Collect 5 ml blood.

Zinc (Blood)

μmol/L

<i>Trace Element plasma</i>	0-11m	8-18
	1y-15y	9-18
	>=16y	9-16

Use only Trace element vacutainers (Royal blue top).

BLOOD GAS REFERENCE INTERVALS

TEST	AGE	ARTERIAL	AGE	VENOUS	UNIT
pH	0 – 24 hr	7.26 – 7.49	≥0d	7.32 – 7.43	
	24 – 48 hr	7.30 – 7.46			
	2d-30d	7.32 – 7.46			
	≥1m	7.35 – 7.45			
PCO ₂	0 – 48 hr	27 – 40	≥0d	37 – 50	mmHg
	2d-30d	27 – 41			
	1m-11m	28 – 42			
	1y-2y	29 – 42			
	3y-6y	32 – 42			
	7y-11y	33 – 42			
	12y-17y	34 – 43			
≥18y	36 – 45				
pO ₂	0d – 24 hr	55 – 80	≥0d	33 – 44	mmHg
	24 – 48 hr	55 – 95			
	≥2d	85 – 110			
HCO ₃	0d-30d	17 – 25	≥0d	22 – 28	mmol/L
	1m-11m	17 – 27			
	1y-12y	19 – 28			
	≥13y	21 – 28			
Base Excess	0d-1d	-10 to -2	≥0d	3- to 3	mmol/L
	2d-7d	-7 to -1			
	8d-12y	-4 to 2			
	≥13y	-3 to 3			
O ₂ Saturation	0d-2d	40 – 90	≥0d	70 - 80	%
	≥3d	>95			
Sodium	0d-7d	133 – 146	≥0d	134 - 146	mmol/L
	8d-30d	134 – 144			
	1m-12y	134 – 143			
	≥13y	134 – 146			

BLOOD GAS REFERENCE INTERVALS

TEST	AGE	ARTERIAL	AGE	VENOUS	UNIT
Potassium	0d-7d	3.2 – 6.0	≥0d	3.4 – 5.0	mmol/L
	8d-30d	3.4 – 6.0			
	1m-5m	3.4 – 5.6			
	6m-11m	3.4 – 5.1			
	≥1y	3.4 – 5.0			
Chloride	0d-7d	96 – 111	>0d	98 – 108	mmol/L
	8d-6m	96 – 110			
	7m-12y	96 – 109			
	≥13y	98 – 108			
Anion Gap	≥0d	7 – 17	≥0d	7 - 17	mmol/L
Ionised Calcium	0d-2d	1.05 – 1.30	≥0d	1.12 – 1.32	mmol/L
	3d-14d	1.10 – 1.40			
	≥15d	1.12 – 1.32			
Glucose	0d-2d	2.6 – 5.4	≥0d	3.0 – 5.4	mmol/L
	3d-12y	3.0 – 5.4			
	≥13y	3.0 – 5.4			
Lactate	≥0d	<1.3	≥0d	<1.5	mmol/L
Hb	0d – 7d	135 – 195	0d – 7d	135 – 195	g/l
	8d – 35d	100 – 170	8d – 35d	100 – 170	
	36d – 5m	95 – 140	36d – 5m	95 – 140	
	6m – 1y	105 – 140	6m – 1y	105 – 140	
	2y – 5y	110 – 145	2y – 5y	110 – 145	
	6y – 11y	115 – 155	6y – 11y	115 – 155	
	M 12y – 17y	125 – 170	M 12y – 17y	125 – 170	
	F 12y – 17y	120 – 155	F 12y – 17y	120 – 155	
	M >18y	135 – 180	M >18y	135 – 180	
	F >18y	115 – 160	F >18y	115 – 160	

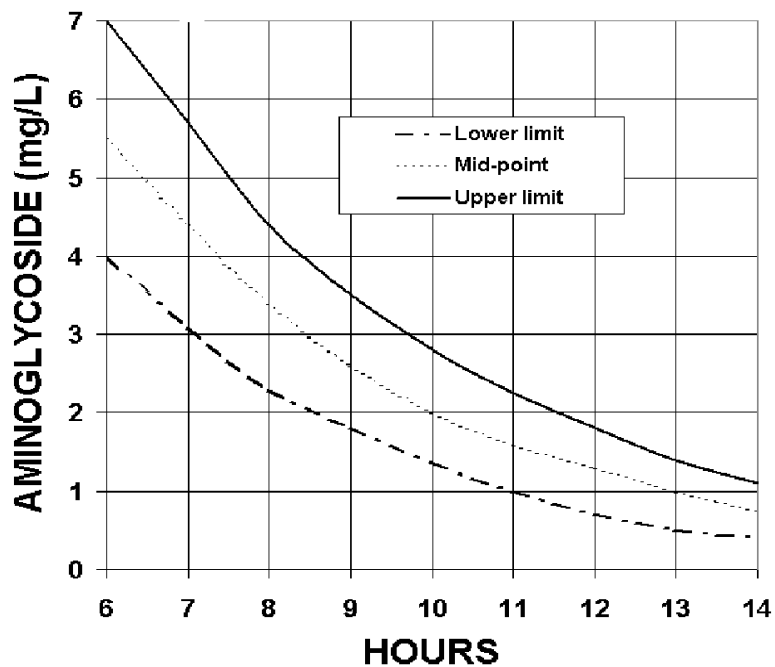
Full Blood Count (Examination)

EDTA

TEST	SEX AGE	M&F 1-7 DAY	M&F 7-35 DAY	M&F 5-11 WK	M&F 3-6MTH	M&F 7M-2YR	M&F 2-6 YRS	M&F 6-12YRS	UNITS
WBC		5.0-25.0	5.0-20.0	5.0-19.5	6.0-17.5	6.0-17.5	5.0-17.0	4.5-14.5	10 ⁹ /l
RBC		3.9-6.3	3.00-5.30	2.70-4.30	3.10-5.50	3.70-5.50	3.90-6.00	4.00-6.00	10 ¹² /l
Hb		135-195	100-170	95-140	95-140	105-140	110-145	115-155	g/l
Hct		0.42-0.65	0.31-0.55	0.28-0.42	0.29-0.44	0.33-0.41	0.34-0.44	0.35-0.45	
MCV		88-118	85-111	77-105	74-97	70-86	72-87	75-92	fl
MCH		28-40	28-36	26-34	25-32	23-30	24-32	25-33	pg
MCHC		295-360	290-370	290-360	300-360	320-360	320-360	320-360	g/l
RDW		9-15	9-15	9-15	9-15	9-15	9-15	9-15	
Plats.		150-400	150-400	150-400	150-400	150-400	150-400	150-400	10 ⁹ /l
MPV		6-10	6-10	6-10	6-10	6-10	6-10	6-10	fl
Retics		80-300	20-130	20-130	20-130	20-130	20-130	20-130	10 ⁹ /l
Retics		1.4-6.0	0.2-2.0	0.2-2.0	0.2-2.0	0.2-2.0	0.2-2.0	0.2-2.0	%
ESR		0-4	0-4	0-9	0-14	0-14	0-14	0-14	mm/hr
Neut		3.0-18.0	1.0-10.0	1.0-9.0	1.0-8.5	1.0-8.5	1.5-8.5	1.5-8.0	10 ⁹ /l
Lymph		2.0-10.0	2.0-17.0	2.5-16.5	4.0-13.5	3.0-13.5	1.5-9.5	1.5-7.0	10 ⁹ /l
Mono		0.2-2.2	0.2-1.8	0.2-1.5	0.2-1.5	0.2-1.2	0.2-1.0	0.2-1.0	10 ⁹ /l
Eos		0.1-0.9	0.1-1.0	0.1-1.0	0.1-0.9	0.1-0.9	0.1-0.8	0.1-0.7	10 ⁹ /l
Baso		0-0.5	0-0.3	0-0.2	0-0.2	0-0.2	0-0.2	0-0.2	10 ⁹ /l

TEST	SEX AGE	MALE 12-18 YR	FEMALE 12-18YR	MALE 18-65 YR	FEMALE 18-65 YR	MALE OVER 65	FEMALE OVER 65	FEMALE Pregnant	UNITS
WBC		4.5-13.0	4.5-13.0	4.0-11.0	4.0-11.0	4.0-11.0	4.0-11.0	5.0-15.0	10⁹/l
RBC		4.50-5.50	3.80-4.80	4.50-5.50	3.80-4.80	4.50-5.50	3.80-4.80	3.70-4.70	10¹²/l
Hb		125-170	120-155	135-180	115-160	135-180	115-160	110-146	g/l
Hct		0.37-0.49	0.36-0.47	0.40-0.54	0.36-0.47	0.40-0.54	0.37-0.47	0.33-0.43	
MCV		78-94	78-94	80-100	80-100	80-100	80-100	81-99	fl
MCH		25-35	25-35	27-32	27-32	27-32	27-32	26-32	pg
MCHC		320-360	320-360	320-360	320-360	320-360	320-360	310-370	g/l
RDW		9-15	9-15	9-15	9-15	9-15	9-15	9-15	
Plats		150-400	150-400	150-400	150-400	150-400	150-400	150-400	10⁹/l
MPV		6-10	6-10	6-10	6-10	6-10	6-10	6-10	fl
Retics		20-130	20-130	20-130	20-130	20-130	20-130	40-150	10⁹/l
Retics		0.2-2.0	0.2-2.0	0.2-2.0	0.2-2.0	0.2-2.0	0.2-2.0	1.0-6.0	%
ESR		1-15	1-15	1-15	1-20	1-30*	1-35*	1-20	mm/hr*
Neut		1.8-8.0	1.8-8.0	2.0-7.5	2.0-7.5	2.0-7.5	2.0-7.5	2.7-10.7	10⁹/l
Lymph		1.5-5.0	1.5-5.0	1.2-4.0	1.2-4.0	1.2-4.0	1.2-4.0	2.0-5.4	10⁹/l
Mono		0.2-1.0	0.2-1.0	0.2-1.0	0.2-1.0	0.2-1.0	0.2-1.0	0.2-1.0	10⁹/l
Eos		0.1-0.6	0.1-0.6	0-0.5	0-0.5	0-0.5	0-0.5	0-0.4	10⁹/l
Baso		0-0.2	0-0.2	0-0.2	0-0.2	0-0.2	0-0.2	0-0.1	10⁹/l

- **ESR of limited value in detecting disease in the elderly.**

AMINOGLYCOSIDE GRAPH

Hepatitis:

TEST	INTERPRETATION
Hepatitis A IgM (+/-IgG)	Recent infection.
IgG	Past infection or immunisation (provided IgM is negative).
Hepatitis B Hepatitis B surface antigen (HBsAg)	Current infection and infectivity. May be acute infection or a carrier. Persistence, if HBsAg is present for > 6 months, it defines a carrier state.
Hepatitis B core antibody (HBcAb)	Current or past hepatitis B infection. Not found after immunisation.
Hepatitis B core IgM (HBcAb-IgM)	Recent infection with hepatitis B. When HBsAg is present HBcAb-IgM suggests acute infection, while its absence suggests the carrier state.
Hepatitis B e antigen (HBeAg)	When HBsAg is present HBeAg indicates high replication and high infectivity, acute infection or carrier state.
Hepatitis B e antibody (HBeAb)	When HBsAg is present HBeAb indicates low level replication and low infectivity carrier state. This is not true for precore mutant virus.
Hepatitis B surface antibody (HBsAb)	Past infection or immunisation.
Hepatitis C Hepatitis C antibody (by EIA)	Indicates current or past infection with hepatitis C. Requires confirmation by a second (different) EIA or by immunoblot.
Hepatitis C antibody (by immunoblot)	Indicates current or past infection with hepatitis C.
Hepatitis C virus RNA (by PCR)	Indicates active hepatitis C and infectivity. Repeat testing is recommended if the result is not clinically consistent and for all negative samples.
Hepatitis D Delta agent antibody	Infection with hepatitis D. Patient must also be HBsAg positive.
Hepatitis E IgG	Indicates recent or past infection with hepatitis E.