

CORE LAB REFERENCE INTERVALS – MILLENNIUM

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CHEMISTRY REFERENCE INTERVALS

A-1-ANTITRYPSIN⁵³

Alpha-1 antitrypsin (AAT) is a protein in the blood that protects the lungs from damage caused by activated enzymes.

0.9-2.0 g/L

ACAC^A

Acetoacetate determines the amount of ketones in the blood to help diagnose diabetic ketoacidosis.

<0.1 mmol/L

ACTH^C

Plasma ACTH measurements are useful in the differential diagnosis of pituitary Cushing's disease (ACTH hypersecretion), autonomous ACTH producing pituitary tumours (eg Nelson's syndrome), hypopituitarism with ACTH deficiency and ectopic ACTH syndrome.

Similarly, ACTH measurements can be employed to facilitate differential diagnosis of adrenocortical insufficiency (Addison's disease).

7-60 ng/L

AMINOGLYCOSIDES¹¹

Ensures adequate dosing and helps avoid toxic side effects.

Amikacin, gentamicin and tobramycin are aminoglycosides which are bactericidal antibiotics used to treat infections caused by aerobic Gram-negative organisms. For therapeutic drug monitoring (TDM) refer to the SA Health Clinical Guideline Aminoglycoside: Recommendations for Use, Dosing and Monitoring Clinical Guideline.

ANTI-MULLERIAN HORMONE (AMH)^{80/81/82/83}

AMH is used in women to evaluate ovarian function and fertility; sometimes in the evaluation of polycystic ovarian syndrome (PCOS), or to evaluate the effectiveness of ovarian cancer treatment. To evaluate the presence of non specific external sex organs (ambiguous genitalia) and/or function of the testicles in a male infant.

	Age	2.5 Percentile pmol/L	97.5 Percentile pmol/L
Male	0-60 days	108.0	1903.0
	Tanner Stage 1	35.0	1032.0
	Tanner Stage 2	36.0	1000.0
	Tanner Stage 3	19.0	542.0
	Tanner Stage 4	3.0	144.0
	Tanner Stage 5	14.0	151.0
	18-110 yrs	5.5	103.0
Female	0-28 days	0.0	6.7
	29-364 days	0.0	31.2
	1-4.99 yrs	1.0	43.7
	5-7.99 yrs	1.4	39.5
	8-11.99 yrs	2.9	52.8
	12-14.99 yrs	3.0	46.6
	15-18.99 yrs	2.1	84.1
	19-24	8.7	83.6
	25-29	6.4	70.3
	30-34	4.1	58.0
	35-39	1.1	53.5
	40-44	0.2	39.1
	45-50	0.1	19.3

B12 AND FOLATE^{1/22/J/BB}

Vitamin B12 is important for DNA synthesis, regenerating methionine for protein synthesis and methylation, as well as for the development and initial myelination of the central nervous system (CNS) and for the maintenance of normal CNS function. Folate (folic acid) is vital for normal cellular functions and plays an essential role in nucleic acid synthesis, methionine regeneration, shuttling and redox reactions of one-carbon units required for normal metabolism and regulation. Red Cell Folate quantitative determination of folate in erythrocytes (red blood cells, RBC).

B12 (pmol/L)		>260
Active B12 (pmol/L)	Deficient	<25
	Insufficient	25-50
	Sufficient	>50
Serum folate (nmol/L)		6-45
Red cell folate (nmol/L)		1426-3294

BETA 2 MICROGLOBULIN SERUM (B2M)⁵³

Evaluates the severity and prognosis of certain cancers.

0.6-2.9 mg/L

BETA 2 MICROGLOBULIN URINE (B2M)^{88/GG}

Male ≤ 0.30mg/L

Female ≤ 0.18mg/L

B2M/Creatinine ratio ≤ 0.03mg/mmol

BETA hCG - QUALITATIVE (PREGNANCY TEST)⁵³

Intended for the early detection of pregnancy.

Interpretation	IU/L
Negative	<5
Equivocal	5-25
Positive	>25

BETA hCG – QUANTITATIVE⁵³

Intended for the early detection and monitoring of pregnancy.

Gestational Age (weeks post LMP)	IU/L
2-3	0-70
3-4	10-750
4-5	200-7000
5-6	200-32000
6-8	4000-150000
8-12	64000-210000
14	14000-62000
15	12000-70000
16	9000-56000
17	8000-56000
18	8000-58000

NB – Dates calculated from last menstrual period.

BETA HYDROXYBUTYRATE^{6/57}

Determines the amount of ketones in the blood.

<7 yrs 0.1-1.0 mmol/L

>7 yrs <0.3 mmol/L

BILE ACIDS^{78/84/CC}

An aid in the determination of hepatic dysfunction as a result of chemical and environmental injury.

Normal 0-7 umol/L

Pregnancy 0-19 umol/L

CARBAMAZEPINE⁵²

Ensures adequate dosing and helps avoid toxic side effects.

20-50 umol/L

CERULOPLASMIN⁵⁰

Tested along with copper testing, to help diagnose Wilson disease.

Age	g/L
0-1 yr	0.07-0.31
1-10 yrs	0.18-0.36
10-13 yrs	0.13-0.22
13-150 yrs	0.18-0.40

CHEMISTRIES – GENERAL

Determines a person's general health status, help evaluate, for example, the body's electrolyte balance and/or the status of several major body organs.

Analyte	Age Range	Reference Interval
Ammonia ^{26/I} (umol/L)	0-1 month	0-99
	Adult	0-49
Albumin ^{2/O} (g/L)	0-1 mth	26-43
	1 mth-1 yr	28-48
	1 yr-18 yrs	31-48
	Adult	34-48
ALP ^{38/39/59} (U/L)	Pregnancy	30-40
	0-<1 wk	80-380
	1-<4 wks	120-550
	4-<26 wks	120-650
	26 wks-<2 yrs	120-450
	2-<6 yrs	120-370
	6-<10 yrs	120-440
	10-<14 yrs Male	130-530
	10-<13 yrs Female	100-460
	14-<15 yrs Male	105-480
	13-<14 yrs Female	70-330
	15-<17 yrs Male	80-380
	14-<15 yrs Female	50-280
	17-<19 yrs Male	50-220
	15-<16 yrs Female	45-170
19-<22 yrs Male	45-150	
16-<22 yrs Female	35-140	
ALT ^{38/39/59/P} (U/L)	Adult	30-110
	Pregnancy	30-215
	0-18 yrs	0-35
AST ^{38/39/59/P} (U/L)	Adult	0-55
	Pregnancy	0-30
	0-1 mth	0-50
	1 mth-1 yr	0-80
	1-4 yrs	0-70
	4-7 yrs	0-60
	7-18 yrs	0-40

Adult	0-45
Pregnancy	0-40

Analyte	Age Range	Reference Interval
Amylase ⁵³ (U/L)	0-1 mth	0-10
	1-6 mths	0-20
	6 mths-1 yr	0-45
	1-18 yrs	0-90
	Adult	20-100
Anion Gap ⁵³ (mmol/L) ([Na ⁺]+[K ⁺]) - ([Cl ⁻]+[HCO ₃ ⁻])	0-18 yrs	5-17
	Adult	7-17
	Pregnancy <18 yrs	5-17
	Pregnancy >18 yrs	7-17
Bicarbonate ^{38/59} (mmol/L)	0-<1 wk	15-28
	1 wk-<2 yrs	16-29
	2-<10 yrs	17-30
	10-<18 yrs	20-32
	Adult	22-32
Calcium ^{38/39/59} (mmol/L)	Pregnancy	20-28
	0-<1 wk	1.85-2.80
	1-<26 wks	2.20-2.80
	26 wks-<2 yrs	2.20-2.70
	2-<18 yrs	2.20-2.65
Calcium Ionised (calculated) ⁴⁹ (mmol/L)	Adult	2.10-2.60
	>16 yrs	1.10-1.30
Chloride ^{38/39/59} (mmol/L)	Pregnancy	1.10-1.30
	0-<1 wk	98-115
CK ⁵⁷ (U/L)	1 wk-<18 yrs	97-110
	Adult	95-110
	0-10 yrs Male	0-180
	10-18 yrs Male	0-250
	0-18 yrs Female	0-150
	Adult Male	0-250
	Adult Female	0-150

Analyte	Age Range	Reference Interval
Creatinine ^{53/56/59} (umol/L)	0-<1 wk	22-93
	1-<4 wks	17-50
	4 wks-<2 yrs	11-36
	2-<6 yrs	20-44
	6-<12 yrs	27-58
	12-<15 yrs Male	35-83
	12-<15 yrs Female	35-74
	15-<19 yrs Male	50-100
	15-<19 yrs Female	38-82
		Adult Male
	Adult Female	45-90
	Pregnancy	30-70
Conjugated Bilirubin ⁵³ (umol/L)	0-1 mth	0-10
	1 mth-Adult	0-5
eGFR ²⁹ (mL/min/1.73m ²)	Adult	>90
	<i><60 is a clinical decision point</i>	
GGT ^{38/39/53/59} (U/L)	0-6 months	0-140
	6 mths-18 years	0-40
	Adult	0-60
	Pregnancy	5-30
Globulins ^{38/39/59/Z} (g/L)	0-1 years	17-29
	1-12 years	20-36
	12 years-Adult	21-41
	Pregnancy	21-41
	Adult	21-41
Glucose ^{39/53} (mmol/L)	0-3 mths Fast/Non Fasting	2.6-7.0
	3 mths- 15 yrs Fasting	3.0-5.5
	15 yrs – Adult Fasting	3.2-5.5
LD ^{38/39/59} (U/L)	0-1 mth	125-765
	1 mth-1 yr	170-450
	1-7 yrs	135-395
	7-16 yrs	110-325
	16 yrs-Adult	120-250
	Pregnancy	70-230
Lactate ^{38/39/53/59} (mmol/L)	0-18 yrs	0-3
	Adult	0.2-2.0
Lipase ^{53/57} (U/L)	0-1 yr	0-30
	1-13 yrs	0-40
	13-18 yrs	0-50
	Adult	0-60
Magnesium ^{38/39/59} (mmol/L)	0-<1 wk	0.60-1.00
	1 wk-<18 yrs	0.65-1.10
	Adult	0.7-1.10

Analyte	Age Range	Reference Interval
Phosphate ^{38/39/59} (mmol/L)	0-<1 wk	1.25-2.85
	1-<4 wks	1.50-2.75
	4-<26 wks	1.45-2.50
	26 wks-<1 yr	1.30-2.30
	1-<4 yrs	1.10-2.20
	4-<15 yrs	0.90-2.00
	15-<18 yrs	0.80-1.85
	18-<20 yrs	0.75-1.65
	Adult	0.75-1.50
	Pregnancy	0.75-1.4
Potassium ^{38/39/59} (mmol/L)	0-<1 wk	3.5-6.2
	1-<26 wks	3.8-6.4
	26 wks-<2 yrs	3.5-5.4
	2-<18 yrs	3.3-4.9
	Adult	3.5-5.2
	Pregnancy	3.3-4.7
Protein ^{38/39/59} (g/L)	0-1 mth	41-63
	1-6 mths	44-67
	6 mths-1 yr	55-79
	1-18 yrs	57-80
	Adult	60-80
	Pregnancy	58-72
Rheumatoid Factor ⁵³ (IU/mL)	All ages	<14
Sodium ^{38/39/59} (mmol/L)	0-<1 wk	132-147
	1 wk-<18 yrs	133-144
	Adult	135-145
	Pregnancy	131-142
Total Bilirubin ^{26/53} (umol/L)	0-1 day	0-85
	1-2 days	0-145
	2-3 days	0-190
	3-4 days	0-210
	4-14 days	0-225
	14 days - Adult	2-24

Analyte	Age Range	Reference Interval
Urate ^{38/39/59/71/AA} (mmol/L)	0-1 mth	0.06-0.27
	1 mth- 1 yr	0.07-0.33
	1-10 yrs	0.11-0.33
	10-13 yrs	0.13-0.35
	13-16 yrs Male	0.18-0.41
	13-16 yrs Female	0.13-0.38
	16-18 yrs Male	0.22-0.45
	16-18 yrs Female	0.14-0.39
	Adult Male	0.20-0.42
	Adult Female	0.14-0.34
Urea ^{38/39/53/59} (mmol/L)	Pregnancy	0.12-0.35
	0-30 days	1.0-6.0
	1 mth-1 yr	0.7-5.0
	1-10 yrs	1.1-5.7
	10-18 yrs	1.8-7.1
	Adult	2.7-8.0
	Pregnancy	1.2-4.0

C-PEPTIDE^L

To quantify the endogenous insulin secretion, C-peptide is measured basally, after fasting and after stimulation and suppression tests.
366-1466 pmol/L (fasting)

CORTISOL¹⁴

Quantitative determination of cortisol in human serum, plasma and saliva. The determination of cortisol is used for the recognition and treatment of functional disorders of the adrenal gland.

RCO	Random Cortisol	nmol/L
At 0900h		133-540
At 1700h		<250
At 2300h		<200
Long Synacthen Test		
<i>(This test is only done as a further investigation when insufficiency is already established)</i>		
	Secondary Adrenal Insufficiency	>500
	Primary Adrenal Insufficiency	<500
SST	Short Synacthen Test²⁴	
30 or 60 min		
Normal		> 450 in at least one post stimulation sample
Adrenal Insufficiency		<550
DST	Dexamethasone Suppression Test (for Cushings)	
Between 0800h and 1000h		
Normal		<50
Borderline		50-150
Abnormal		>150
DST	Dexamethasone Suppression Test (for Melancholia)²⁴	
At 1600h and 2300h		A cortisol level of > 160 confirms the presence of melancholia with 96% specificity. Levels of < 160 do not exclude melancholia.

C-REACTIVE PROTEIN^{26/53}

Checks for infection or inflammation in the body. Used to detect the severity of inflammation and whether responding to treatment.

CRP 0-8 mg/L

Relative Cardiovascular Risk	Low risk	Intermediate risk	High risk
hsCRP (mg/L) ^H	<1	1.0-3.0	>3

A number of different clinical applications are used for this test with varying levels of significance. It is recommended interpretation be based on changes with serial CRP values and in conjunction with other prognostic/risk factors.

CREATINE KINASE – MB⁵³

The determination of CK-MB mass in serum is an important element in the diagnosis of myocardial ischemia, e.g. in acute myocardial infarction, myocarditis.

	Male	Female
Total CK (U/L)	<250	<150
CK-MB (ug/L)	<7	<7
CK-MB/Total CK	<2.6%	<2.6%

CREATININE CLEARANCE^{31/40}

Measures the concentration of creatinine in a sample of urine from a 24-hour urine collection and a blood sample. The results are used to calculate the amount of creatinine that has been cleared from the blood and passed into the urine over a 24 hour time period.

Males 90-180 mL/min

Females 80-160 mL/min

Pregnancy 100-200 mL/min

Decreases with increasing age – about 10% per decade after the age of 50 years.

(Calculated parameter)

Blood sample required during the 24 hr collection
$$\frac{\text{(urine creatinine x 24 hr volume in mLs)}}{\text{(blood creatinine/1000) x 60 x 24}}$$

C-TELOPEPTIDE (CROSSLAPS)^{16/27/35/61/73/74}

Aids in assessing bone resorption, monitoring antiresorptive therapies (eg bisphosphonates, hormone replacement therapies) in individuals diagnosed with osteopenia.

Age (years)	ng/L	
0-1 mth	450-2250	
1 mth-1 yr	200-2300	
1-2 yrs	Male	600-1750
	Female	450-1600
2-5 yrs	Male	500-1750
	Female	550-1900
5-7 yrs	Male	575-1800
	Female	450-1950
6-9 yrs	Male	1050-2400
7-10 yrs	Female	800-2050
9-15 yrs	Male	1000-2900
10-14 yrs	Female	500-2750
14-15 yrs	Female	125-1725
15-20 yrs	Male	500-2500
	Female	<1600
Adult desirable range	<400	

CSF^{7/53}

To diagnose a disease or condition affecting the central nervous system such as infection, bleeding within the brain or skull, cancer, or autoimmune disorder.

Glucose (mmol/L)	0-1 yr	1.7-4.4
	1 yr-Adult	2.2-5.5
Protein (g/L)	0-1 months	0-3
	1-2 months	0-2
	2-3 months	0-1
	3 months-Adult	0.15-0.45
Lactate (mmol/L)	Adult	1.2-2.1

CSF BILIRUBIN⁶³

Aids in the diagnosis of recent subarachnoid or cerebral bleed, head injury, or previous bloody tap.

Net Bilirubin Absorbance	0.0000 – 0.0070 A
Net Oxyhaemoglobin Absorbance	0.00 – 0.02 A

CYCLOSPORIN (NEORAL)⁵³

In vitro quantitative determination of cyclosporine in human whole blood. Used as an aid in the management of heart, liver, kidney, lung and bone marrow transplant patients receiving cyclosporine therapy.

	µg/L
Trough (C0)	80-250
Peak (2 hr post dose) (C2)	<i>This varies per transplant type. Refer to local protocols</i>

DHEAS^{32/35/W}

Measurement of DHEA-S can be useful in the diagnostic workup of female patients presenting with clinical symptoms of hyperandrogenism. Three elevated DHEA-S levels are indicative of an involvement of the adrenal gland. A decrease of DHEA-S and total serum testosterone by more than 50% upon dexamethasone suppression is seen as confirmation of hyperandrogenism of the adrenal gland.

	Male umol/L	Female umol/L
<30 days	<14	<14
30 days-<12 yrs	<6	<6
12-<14 yrs	0.7-6.7	0.9-7.6
15-74 yrs	1.8-11.6	1.8-9.2
≥75 yrs	0.4-3.3	0.3-4.2

DIGOXIN⁶⁶

Measurements are used in the diagnosis and treatment of digoxin overdose and in monitoring levels of digoxin to ensure proper therapy.

0.6-1.0 nmol/L Trough level

ERYTHROPOIETIN²⁰

Measurement aids in the differentiation of different types of anaemia.

4-29 mU/mL

FAECAL ELECTROLYTES⁵⁵

Measures the concentration (osmolality) of certain particles in a sample of watery stools. The amount of sodium, potassium, and other substances in stools can affect its consistency.

Faecal osmotic gap (mosmol/kg) = measured faecal osmolality – 2 x ([faecal Na] + [faecal K])

Interpretation:

- Osmotic gap > 160 mosmol suggests osmotic diarrhoea.
- A negative osmotic gap suggests secretory diarrhoea.
- Bacterial metabolism increases the osmotic gap. Faeces should be refrigerated after collection. If faeces cannot be analysed within 24 hours, it should be frozen.
- Low faecal osmolality with normal serum osmolality implies water has been added to the faeces.

POTASSIUM – FAECES

50-100 mmol/L

SODIUM – FAECES

50-100 mmol/L

FAI^{33/60/65}

Sex hormone-binding globulin (SHBG) is the blood transport protein for testosterone and oestradiol (E2). Testosterone promotes the development of the secondary sex characteristics, such as the growth of pubic, facial, and axillary hair or the accessory sex organs.

		SHBG nmol/L	Calculated Free T nmol/L**
0-31 days	Male	11-71	
	Female	12-51	
31 days-1 yr	Male	60-209	
	Female	51-181	
1 yr-4 yrs	Male	42-156	
	Female	51-158	
4-7 yrs	Male	39-146	
	Female	48-142	
7-10 yrs	Male	38-114	
	Female	31-103	
10-13 yrs	Male	32-93	
	Female	20-190	
13 -16 yrs	Male	13-63	
	Female	17-77	
16-18 yrs	Male	11-54	
	Female	9-75	
18-150 yrs	Male	10-45	0.20 - 0.60
18-55 yrs	Female	25-90	
55-150 yrs	Female	20-90	

Testosterone

Male	nmol/L	Female	nmol/L
0-7 yrs	0.1-1.1	0-6 yrs	0.1-0.3
7-10 yrs	0.1-0.9	6-10 yrs	0.2-0.5
10-13 yrs	0.2-14.5	10-15 yrs	0.5-1.9
13-15 yrs	0.2-22.5	15-17 yrs	0.4-1.8
15-16 yrs	1.5-30.5	17-18 yrs	0.6-1.9
16-150 yrs	8-30	18-55 yrs	0.2-2
		55-150 yrs*	0-1.49

*After the age of 60 some postmenopausal women may have lower levels due to declining adrenal production.

**The Free Testosterone calculation assumes a serum/plasma albumin value of 44 g/L. The reference interval is provisional.

FREE HAEMOGLOBIN³⁷

Measures the level of free haemoglobin in plasma.

0-19 mg/L

FREE PHENYTOIN (CALCULATED)⁹

Preferred test for therapeutic drug management in patients with renal failure or conditions that may alter albumin concentrations.

4-8 umol/L

GLUCOSE-6-PHOSPHATE DEHYDROGENASE^{79/89/DD/EE}

G6PD helps red blood cells function normally.

0-90 days 5-24 U/g Hb

>90 days 5.0-13.0 U/g Hb

GLUCOSE TOLERANCE

The Glucose Tolerance Test (GTT) measures how quickly a dose of glucose is cleared from the blood.

Non-Pregnant ^{75/76}	mmol/L
Fasting	≤ 6.0
2 hr	<7.8

Pregnant ^{3/77} (recommend repeat OGTT at 6-8 weeks post partum)	
Fasting	<5.1
1 hr	<10
2 hr	<8.5

HAPTOGLOBIN⁵¹

Used to help determine whether red blood cells are breaking apart or being destroyed prematurely.

0.5-2.5 g/L

HAEMOGLOBIN A1C²⁵

Evaluates the average amount of glucose in the blood over the last 2 to 3 months by measuring the relationship of glycated (glycosylated) haemoglobin.

Pregnant

Target HbA1c level for pregnant women with known diabetes is $\leq 6\%$ or $\leq 42\text{mmol/mol}$.
HbA1c is not recommended as a screening test for gestational diabetes.

Patients <15 years of age

Target HbA1c level for children/adolescents with type 1 diabetes is $\leq 7.5\%$ or $\leq 58\text{mmol/mol}$ and with type 2 diabetes is $\leq 7.0\%$ or $\leq 53\text{mmol/mol}$.

Adults (≥ 15 years): HbA1c < 6.5%

If screening for DM: Diabetes unlikely. Recommend re-test in 12 months. If monitoring DM: Increased risk of hypoglycaemia if on insulin/sulfonylureas.

Adults (≥ 15 years): HbA1c 6.5 – 6.9%

If screening for DM: Supports diagnosis of Diabetes. Suggest confirmation with a repeat HbA1c or fasting blood glucose test. If monitoring DM: Within recommended HbA1c target range.

Adults (≥ 15 years): HbA1c 7.0 – 7.9%

If screening for DM: Supports diagnosis of Diabetes. Suggest confirmation with a repeat HbA1c or fasting blood glucose test. If monitoring DM: Within recommended HbA1c target range.

Adults (≥ 15 years): HbA1c $\geq 8.0\%$

If screening for DM: Consistent with Diabetes. If monitoring DM: Poor glycaemic control.

HOMOCYSTEINE^G

Measured as part of the investigation of folate and vitamin B12 deficiency. Also used in the diagnosis of homocystinuria.

Fasting plasma 4-14 $\mu\text{mol/L}$

INSULIN^K

A disorder in insulin metabolism can have a significant impact on a number of metabolic processes. Low concentrations of free, biologically active insulin can lead to the development of diabetes mellitus.

Fasting 0-12 mU/L

IRON STUDIES^{28/57}

Measures how much iron in the blood. A serum ferritin test measures the quantity of a protein that helps store iron in the body. A transferrin test measures how well the body transports iron in the blood. This is sometimes called a total iron-binding capacity test (TIBC).

Ferritin (ug/L)	0-1 mth	150-450
	1-3 mths	80-500
	3 mths-18 yrs	20-200
Serum Iron (umol/L)	Adult Male	30-300
	Adult Female	30-250
	0-18 yrs	8-27
Transferrin (g/L)	Adult	8-30
	0-13 yrs	1.75-3.18
	13-Adult	1.99-3.98
Transferrin saturation (%)	Adult	2-4
	0-18 yrs	5-45
	Adult Male	10-55
	Adult Female	10-35

LIPIDS^{36/38/39/47/57/59}

Determines risk of developing cardiovascular disease and assists in the diagnosis of lipid disorders.

		mmol/L
Total Triglycerides	0-18 yrs	0-1.7
	Adult	0.3-2.0
	Pregnancy	1.0-5.5
Total Cholesterol	0-18 yrs	0-4.5
	Adult desirable	0-5.5
	Pregnancy	2.0-8.0
HDL Cholesterol	0-1 yr	0.1-1.3
	1-2 yrs	0.5-2.0
	2-18 yrs	1.0-1.9
LDL Cholesterol	Adult Male	0.9-2.0
	Adult Female	1.0-2.2
	0-1 yr	0.3-0.9
	1-2 yrs	0.7-3.7
	2-18 yrs	0-2.9
	Adult desirable	0-3.7*
Total Cholesterol/HDL Ratio	Pregnancy	0-3.7*
	0-150 yrs	0-5
	Pregnancy	0-5

*>5.0 indicates a significantly increased risk of CHD

LITHIUM⁴¹

Ensures adequate dosing and helps avoid toxic side effects.

0.4-0.8 mmol/L

**LUTEINISING HORMONE (LH), FOLLICULAR STIMULATING HORMONE (FSH),
OESTRADIOL (E2) AND PROGESTERONE (P4)^{33/X}**

FSH and LH regulate and stimulate the growth and function of the gonads (ovaries and testes) synergistically. E2 – Estrogens are responsible for the development of the secondary female sex characteristics. Utilised in the elucidation of fertility disorders, monitoring of fertility therapy and determining the time of ovulation for IVF. P4 – Progesterone is utilised in fertility diagnosis for the detection of ovulation and assessment of the luteal phase.

	Females				Males
	Follicular Phase	Ovulation Phase	Luteal Phase	Post Menopausal	
LH (IU/L)	2-12	15-200	1-10	>8	1-10
FSH (IU/L)	3-12	5-20	2-8	>25	2-12
E2 (pmol/L)	100-570	180-1150	120-1100	<200	ns
P4 (nmol/L)	<10	ns	>20	ns	≥ 18 yrs <0.5

*Perimenopausal results may fluctuate widely.

MYOGLOBIN^{48/Q}

The determination of myoglobin in serum is an important factor in the diagnosis of acute myocardial infarction (AMI), early re-infarction and successful reperfusion following lysis therapy.

	ug/L
Male	28-72
Female	25-58
Neonatal	34-73

N-TERMINAL PRO-B-TYPE NATRIURETIC PEPTIDE²³

Aids in the diagnosis of individuals suspected of having congestive heart failure and detection of mild forms of cardiac dysfunction.

0-124 ng/L

OSMOLARITY^{53/57}

Measures the body's electrolyte-water balance.

CALCULATED	Age	mmol/L
Calculated Osmo is only displayed when Na <126 or >149	0-18 yrs	275-305
1.86 [Na + K] + [glucose] + [urea]		
MEASURED	Adult	265-285
	Pregnancy <18 yrs	275-305
	Pregnancy >18 yrs	265-285

P1NP^{5/16/27/64}

This assay is intended for use in monitoring therapy following the diagnosis of osteoporosis in post-menopausal women and in patients diagnosed with Paget's disease.

Age (years)		ug/L
<1 mth		775-3200
1 mth-1 yr		550-2175
1-6 yrs		175-1025
6-11 yrs	Male	400-1075
6-10 yrs	Female	400-1025
10-11 yrs	Female	250-1450
11-14 yrs	Male	350-1400
	Female	100-1350
14-15 yrs	Male	275-1215
	Female	50-500
15-18 yrs	Female	50-275
15-20 yrs	Male	50-725
20-25 yrs	Male	15-115
>25 yrs	Male	15-80
18-30 yrs	Female	25-90
30-39 yrs	Female	15-80
30-49 yrs	Female	15-60
>50	Female	15-75

PARACETAMOL⁵⁴

To determine if an overdose has occurred; to determine risk of liver damage and to help determine if treatment with an antidote is required.

65-130 umol/L

PREECLAMPSIA (PE) MARKERS – SFLT-1/PLGF^{85/86/87}

Diagnostic markers for preeclampsia.

sFLT-1/PLGF Ratio		
Short term Predictive	Unlikely (Within 1 week)	≤38
	Likely (within 4 Weeks)	>38
Diagnosis	Negative	<33
	Positive- Early gestation (weeks 20+0 -33+6)	>85
	Positive- Late gestation (weeks 34+0 – delivery)	>110

PHENOBARBITONE⁵²

Ensures adequate dosing and helps avoid toxic side effects.

≤28 days of age 45-130 umol/L

>28 days of age 45-170 umol/L

PHENYTOIN^{52/58}

Ensures adequate dosing and helps avoid toxic side effects.

≤28 days of age 25-60 umol/L

>28 days of age 40-80 umol/L

PROLACTIN^{57/T}

Assessment can be used to assess a number of medical conditions - infertility, pregnancy, tumour marker and evaluation of pituitary disorders.

Age	mIU/L	
<30 days	<7500	
30 days-<1 yr	<1200	
1 yr-16 yrs	Male	<600
	Female	<750
≥17 yrs	Male	90-400
17-55 yrs	Female	90-630
>55 yrs	Female	80-500

PSA – PROSTATIC SURFACE ANTIGEN¹³

Total prostate specific antigen aids in the detection of prostate cancer. Free PSA aids in the detection of prostate cancer.

Age	Total PSA (ug/L)	Age related medians (ug/L)
<40	0.3-2.0	0.7
40-49	0.3-2.7	0.8
50-59	0.3-4.0	0.9
60-69	0.3-6.6	1.4
70-79	0.2-8.8	1.8
>79	0.2-9.4	1.9

PSA should not be used as the sole criterion for the diagnosis of prostate cancer. Raised PSA can be associated with prostatitis, benign prostatic hyperplasia, urinary retention and UTI.

PTH – PARATHYROID HORMONE⁶²

Differential diagnosis of hypercalcaemia and hypocalcaemia.

0.8 – 5.5 pmol/L

RENIN AND ALDOSTERONE^{57/B}

Aldosterone is a hormone that regulates the retention of sodium (salt) and water by the kidney and also regulates the excretion of potassium. It plays an important role in the control of blood pressure. Renin is released from the kidney when there is a drop in blood pressure, a decrease in sodium concentration, or an increase in potassium concentration.

	Age	Erect/Seated	Supine
Aldosterone (pmol/L)	0-1 yr	no RI quoted	no RI quoted
	1-2 yrs	190 - 1500	190 - 1500
	2-10 yrs	80 - 970	80 - 970
	10-18 yrs	60 - 610	60 - 610
	>18 yrs	60 - 980	30 - 650
Direct Renin (uIU/mL)	0 - 1 week	10 - 500	10 - 500
	1 week - 2 yrs	5 - 100	5 - 100
	2 - 10 yrs	5 - 60	5 - 60
	10 - 18 yrs	7 - 50	7 - 50
	> 18 yrs	10 - 50	4 - 40

Urine (nmol/24 hr) Adult

3-78

Screening for primary hyperaldosteronism is considered positive if:

Aldosterone (erect/seated) is > 400 pmol/L AND Aldo/Renin ratio is >50.

SALICYLATE⁷²

Diagnosis of salicylate overdose. This test is also used to check for the correct aspirin dose in people who are given high doses of aspirin to treat inflammation from arthritis.

<0.03	Below limit of quantitation
0.03-2.20	Toxicity unlikely, within concentrations seen at therapeutic doses for analgesia
2.21-3.6	Concentrations associated with toxicity
>3.6	Concentrations associated with severe toxicity

SEROLOGY

These tests detect antigens/antibodies.

Results are reported as interpretative comments only.

SODIUM - SPOT URINE⁵³

Measurement of sodium in the urine. Urine sodium varies widely according to sodium and fluid intake.

Na <20 mmol/L in the presence of hyponatraemia.

Osmolality depends on the fluid intake at that time – can be 100-1200 mOSM/kg.

TACROLIMUS⁷⁰

In vitro quantitative determine of tacrolimus in human whole blood. Used as an aid in the management of heart, liver and kidney transplant patients receiving tacrolimus therapy.

Therapeutic levels 5-15 ug/L

THEOPHYLLINE^{34/53}

Ensures adequate dosing and helps avoid toxic side effects.

Age	umol/L
0-3 mths	30-65
3 mths-150 yrs	50-110

THYROGLOBULIN/ANTI-THYROGLOBULIN^Y

Determination of thyroglobulin: aid in monitoring after thyroid ablation. Anti-TG: aid in the detection of autoimmune thyroid diseases.

TG	<77 kU/L
ATG	<115 IU/L – Reported as ‘Not detected’ ≥115 IU/L – Reported as ‘Detected’

**THYROID STIMULATING HORMONE (TSH), FREE THYROXINE (FT4) AND FREE TRI-
IODOTHYRONINE (FT3)⁵⁷**

Assessment and monitoring of thyroid function.

	TSH (mIU/L)	FT4 (pmol/L)	FT3 (pmol/L)
0-2 mths	1.00-12.5	12-27	4.5-8.00
2-12 mths	0.8-7.3	12.00-22.00	4.5-8.00
1 yr-5 yrs	0.8-6.60	11.00-20.00	4.5-8.00
5-10 yrs	0.8-6.00	11.00-20.00	4.5-8.00
10-14 yrs	0.7-5.8	11.00-20.00	4.5-8.00
14-18 yrs	0.60-5.40	11.00-20.00	4.00-7.00
Adult	0.5-4.5	10-20	3.1-5.4

THYROID IN PREGNANCY⁴²

Assessment and monitoring of thyroid function.

Time	TSH (mIU/L)	FT4 (pmol/L)	FT3 (pmol/L)
1 st Trimester	0.10-2.5	12-21	3.6-5.2
2 nd Trimester	0.20-3.0	10-20	3.5-5.0
3 rd Trimester	0.30-3.0	10-17	3.1-5.4

TROPONIN T^{67/68}

Aids in the differential diagnosis of acute coronary syndrome.

Patient group	ng/L
0-6 months	<87
6 months -1 yr	<39
1-18 yrs	≤11
Adult female	<13
Adult male	<17

TUMOUR MARKERS^{M/N/R/S/69}

CA15-3 aids in management of breast cancer patients. CA19-9 aids in management of pancreatic cancer patients. CA125 aids in detection and management of residual or recurrent ovarian carcinoma after first line therapy. Carcinoembryonic antigen (CEA) aids in the management of colorectal, breast, non-small cell lung cancer patients. hCG to help diagnose and monitor gestational trophoblastic disease or germ cell tumours.

	kU/L
AFP	0-6
CA15-3	<32
CA19-9	<35
CA125	<35
CEA	<8 ug/L
hCG	
Age	IU/L
<18	No reference range
18-45 yrs	<0.3
≥45 yrs Male	<0.5
≥45 yrs Female	<6

URINE – 24 HOUR^{10/24/46}

Used to detect metabolic and kidney disorders.

Analyte	Reference Interval (mmol/24 hrs)
Calcium	2.5-7.5
Creatinine	Females 6-16.0
	Males 8.8-23.0
Magnesium	2.5-5.0
Phosphate	13-55
Potassium	50-140
Sodium	40-100
Urate	2.4-7.0
Urea	170-580

URINE ALBUMIN^{21/30}*Measured in the determination of kidney disease.*

Timed overnight collection (mg/L)		0-25
Timed overnight excretion rate (µg/min)		0-20
Albumin/Creatinine ratio (mg/mmol)	Female <12 yrs	0-3.3
	Male <12 yrs	0-2.9
SPOT	Female 12-18 yrs	0-3.4
	Male 12-18 yrs	0-2.4
	Adult Female	0-3.5
	Adult Male	0-2.5

URINE PROTEIN- SPOT^{4/44}*To help evaluate and monitor kidney function, and to detect kidney damage.*

Protein : creatinine ratio

Reported in mg (protein) per mmol (creatinine)

Patient group	mg/mmol
0-2 yrs	0-50
2-18 yrs	0-20
Adult female – not pregnant	0-18
Adult female – pregnant	0-30
Adult male	0-12

URINE PROTEIN- 24 HOUR^{4/17}*To help evaluate and monitor kidney function, and to detect kidney damage.*

Reported in mg (protein) / 24 hours

Patient group	mg/24 hrs
Males Adults/Females not pregnant	0-150
Pregnant Females	0-300

URINARY RATIOS AND EARLY MORNING SPOT URINES^{10/4/43}

Sodium/Creatinine		3.0-20
Calcium/Creatinine	0-1 yr	0-1.49
	1-2 yr	0-1.24
	2-5 yr	0-.99
	5-10 yrs	0-.69
	10-150 yrs	0-0.59
Phosphate/Creatinine		0.4-2.6
Potassium/Creatinine*		

**No reference intervals as values change to ensure stable serum levels. There are decision limits where major abnormality in serum potassium exist.*

VALPROATE⁵²

Ensures adequate dosing and helps avoid toxic side effects.

300-600 umol/L

VANCOMYCIN¹²

Measures the concentration of vancomycin in the blood. Vancomycin is an antibiotic that is used to treat serious infections caused by gram-positive bacteria.

	mg/L
Peak	
Intravenous = 30 min after completion of 60 min infusion	<50
Trough	
(within 60 mins PRIOR to dose)	15-20

HAEMATOLOGY REFERENCE INTERVALS

COMPLETE BLOOD EXAMINATION^{45/D}

Determines general health status; to screen for, diagnose, or monitor any one of a variety of diseases and conditions that affect blood cells, such as anaemia, infection, inflammation, bleeding disorder or cancer.

TEST	AGE	REFERENCE INTERVAL
Basophils Absolute (10 ⁹ /L)	0-150 yrs	0-0.1
Eosinophils Absolute (10 ⁹ /L)	0-2 days	0.1-1
	3-8 days	0.1-0.8
	9 days-5 yrs	0.1-0.6
	6-12 yrs	0.04-0.4
	13-150 yrs	0.02-0.5
Haemoglobin (g/L)	0-4 days	145-225
	5-8 days	135-215
	9-15 days	125-205
	16 days-8 wks	100-180
	9-14 wks	90-140
	15 wks-7 mths	95-135
	8 mths-3 yrs	105-135
	4-7 yrs	115-135
	8-14 yrs	115-155
	15-150 yrs	
	Male	135-175
Female	115-155	
Haematocrit (L/L)	0-4 days	0.45-0.67
	5-8 days	0.42-0.66
	9-15 days	0.39-0.63
	16 days-8 wks	0.31-0.55
	9-14 wks	0.28-0.42
	15 wks-7 mths	0.29-0.41
	8 mths-3 yrs	0.33-0.39
	4-7 yrs	0.33-0.4
	8-14 yrs	0.33-0.45
	15-150 yrs	
	Male	0.4-0.5
Female	0.35-0.45	
Immature/Total Ratio	0-7 days	0-0.17
	8-27 days	0-0.79
	28 days-150 yrs	No range
Immature Platelet Fraction (%)	0-150 yrs	1.1-6.1

Lymphocytes Absolute (10 ⁹ /L)	0-2 days	2-11
	3-15 days	2-17
	16-27 days	2.5-16.5
	28 days-7 mths	4-13.5
	8-12 mths	4-10.5
	13 mths-3 yrs	3-9.5
	4-5 yrs	2-8
	6-12 yrs	1.5-5
	13-150 yrs	1.1-3.5
Mean Cell Haemoglobin (pg)	0-4 days	31-37
	5 days-8 wks	28-40
	9-14 wks	26-35
	15 wks-7 mths	25-35
	8 mths-3 yrs	23-31
	4-7 yrs	24-31
	8-14 yrs	26-34
	15-150 yrs	27-33
	Mean Cell Haemoglobin Concentration (g/L)	0-14 yrs
15-150 yrs		310-360
Mean Cell Volume (fL)	0-4 days	95-121
	5-8 days	88-126
	9-15 days	86-124
	16 days-8 wks	85-123
	9-14 wks	77-115
	15 wks-7 mths	74-108
	8 mths-3 yrs	70-86
	4-7 yrs	75-88
	8-14 yrs	78-95
15-150 yrs	80-98	
Monocytes Absolute (10 ⁹ /L)	0-8 days	0.2-2.5
	9-15 days	0.2-2
	16-27 days	0.2-1.8
	28 days-12 mths	0.1-1.1
	13 mths-3 yrs	0.2-1.5
	4-5 yrs	0.5-1.5
	6-12 yrs	0.2-1
	13-150 yrs	0.2-0.8
Mean Platelet Volume (fL)	13-150 yrs	9.5-13
Neutrophils Absolute (10 ⁹ /L)	0-2 days	5-21
	3-8 days	1.5-10
	9-15 days	1-9.5
	16-27 days	1-9
	28 days-7 mths	1.8-8.5
	8 mths-5 yrs	1.5-8.5
	6-12 yrs	2-8
	13-150 yrs	1.8-7.5

Non Segmented Neutrophil		No range
Nucleic Red Blood Cells (10 ⁹ /L)		No range
Platelet Count (10 ⁹ /L)	0-3 yrs	150-550
	4-14 yrs	150-500
	15-150 yrs	150-450
Red Cell Count (10 ¹² /L)	0-4 days	4-6.6
	5-8 days	3.9-6.3
	9-15 days	3.6-6.2
	16 days-8 wks	3-5.4
	9 wks-3 mths	2.7-4.9
	4-7 mths	3.1-4.5
	8 mths-7 yrs	3.6-5.3
	8-14 yrs	3.6-5.2
	15-150 yrs	
	Male	4.5-6
	Female	3.8-5.2
Red Cell Distribution Width (%)	0-14 yrs	11-15.5
	15-150 yrs	12-15
Reticulocytes (10 ⁹ /L)	0-7 days	115-415
	8 days-150 yrs	25-100
Reticulocyte (%)	0-7 days	2.5-6.5
	8 days-150 yrs	0.2-3
White Cell Count (10 ⁹ /L)	0-2 days	9-34
	3-8 days	5-21
	9-15 days	5-20
	16-27 days	5-19.5
	28 days-12 mths	6-17.5
	13 mths-3 yrs	6-17
	4-5 yrs	5.5-15.5
	6-12 yrs	4.5-13
	13-150 yrs	4-11

COAGULATION^E

Used to assess blood clotting function.

TEST	AGE	REFERENCE INTERVAL
Prothrombin time (Seconds)	<90 days >3M	No range 12-16
Prothrombin INR Not on anticoagulant therapy (Ratio)	<90 days 3M – 16Y 17 – 999Y	No range 0.9-1.3 0.9-1.2
Prothrombin INR On Warfarin (Ratio)	Therapeutic range Low risk heart valves High risk heart valves	2.0-3.0 Patient specific ranges Seek Cardiologist advice
APTT Not on anticoagulant therapy (Seconds)	<90 days 3M – 16Y 17 – 999Y	No range 28-41 24-38
APTT - on heparin (Seconds)	Therapeutic range	65-110
Fibrinogen (g/L)	<90 days 3M – 999Y	No range 1.5-4.0
Thrombin clotting time (Seconds)	<1Y 1 – 999Y	No range 16-20
D-dimer (mg/L)	<90 days 3M – 60Y 60Y – 70Y 70Y – 80Y 80Y – 150Y	No range <0.50 <0.60 <0.70 <0.80

ERYTHROCYTE SEDIMENTATION RATE (ESR)⁸

The ESR is a non-specific measure of inflammation. The ESR determines the rate at which erythrocytes sediment in plasma. The rate is influenced by a number of factors including plasma protein, haemoglobin and immunoglobulin levels

ESR (mm/hr)	<13 yrs	1-20
	13-50 yrs	
	Male	1-10
	Female (non-pregnant)	1-12
	>50 yrs	
	Male	1-15
Female (non-pregnant)	1-20	

HAEMOGLOBIN VARIANT ANALYSIS

Measures variant forms of haemoglobin.

Hb A2 (%)	1.8-3.2
Hb F (%)	0.0-1.0

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