

## NORMAL RANGES

### Haematology

#### Full blood count

Haemoglobin (males)	13.0 – 18.0 g/dL
Haemoglobin (females)	11.5 – 16.5 g/dL
Haematocrit (males)	0.40 – 0.52
Haematocrit (females)	0.36 – 0.47
MCV	80 – 96 fL
MCH	28 – 32 pg
MCHC	32 – 35 g/dL

#### White cell count

4 – 11 x 10<sup>9</sup>/L

#### White cell differential:

Neutrophils	1.5 – 7 x 10 <sup>9</sup> /L
Lymphocytes	1.5 – 4 x 10 <sup>9</sup> /L
Monocytes	0 – 0.8 x 10 <sup>9</sup> /L
Eosinophils	0.04 – 0.4 x 10 <sup>9</sup> /L
Basophils	0 – 0.1 x 10 <sup>9</sup> /L

#### Platelet count

150 – 400 x 10<sup>9</sup>/L

#### Reticulocyte count

25 – 85 x 10<sup>9</sup>/L

OR 0.5 – 2.4%

#### Erythrocyte sedimentation rate

##### Westergren

##### Under 50 years:

Males 0 – 15 mm/1<sup>st</sup> hr

Females 0 – 20 mm/1<sup>st</sup> hr

##### Over 50 years:

Males 0 – 20 mm/1<sup>st</sup> hr

Females 0 – 30 mm/1<sup>st</sup> hr

#### Plasma viscosity (25°C)

1.50 – 1.72 mPa/s

### Coagulation Screen

Prothrombin time 11.5 – 15.5s

International normalised ratio <1.4

Activated partial thromboplastin time 30 – 40s

Fibrinogen 1.8 – 5.4 g/L

Bleeding time 3 – 8m

#### Coagulation Factors

Factors II, V, VII, VIII, IX, X, XI, XII 50 – 150 IU/dL

##### Factor V Leiden

Von Willebrand factor 45 – 150 IU/dL

Von Willebrand factor antigen 50 – 150 IU/dL

Protein C 80 – 135 IU/dL

Protein S 80 – 120 IU/dL

Antithrombin III 80 – 120 IU/dL

Activated protein C resistance 2.12 – 4.0

Fibrin degradation products < 100 mg/L

D-Dimer screen < 0.5 mg/L

## Haematinics

Serum iron	12 – 30 µmol/L
Serum iron-binding capacity	45 – 75 µmol/L
Serum ferritin	15 – 300 µg/L
Serum transferrin	2.0 – 4.0 g/L
Serum B <sub>12</sub>	160 – 760 ng/L
Serum folate	2.0 – 11.0 µg/L
Red cell folate	160 – 640 µg/L
Serum haptoglobin	0.13 – 1.63 g/L
Haemoglobin electrophoresis:	
Haemoglobin A	> 95%
Haemoglobin A <sub>2</sub>	2 – 3%
Haemoglobin F	< 2 %

## Chemistry

Serum sodium	137 – 144 mmol/L
Serum potassium	3.5 – 4.9 mmol/L
Serum chloride	95 – 107 mmol/L
Serum bicarbonate	20 – 28 mmol/L
Anion gap	12 – 16 mmol/L
Serum urea	2.5 – 7.5 mmol/L
Serum creatinine	60 – 110 µmol/L
Serum corrected calcium	2.2 – 2.6 mmol/L
Serum phosphate	0.8 – 1.4 mmol/L
Serum total protein	61 – 76 g/L
Serum albumin	37 – 49 g/L
Serum total bilirubin	1 – 22 µmol/L
Serum conjugated bilirubin	0 – 3.4 µmol/L
Serum alanine aminotransferase	5 – 35 U/L
Serum aspartate aminotransferase	1 – 31 U/L
Serum alkaline phosphatase	45 – 105 U/L (over 14 years)
Serum gamma glutamyl transferase	4 – 35 U/L (< 50 U/L in males)
Serum lactate dehydrogenase	10 – 250 U/L
Serum creatine kinase (Males)	24 – 195 U/L
Serum creatine kinase (Females)	24 – 170 U/L
Creatine kinase MB fraction	< 5%
Serum troponin I	0-0.4 µg/L
Serum troponin T	0 – 0.1 µg/L
Serum copper	12 – 26 µmol/L
Serum caeruloplasmin	200 – 350 mg/L
Serum aluminium	0-10 µg/L
Serum magnesium	0.75 – 1.05 mmol/L
Serum zinc	6 – 25 µmol/L
Serum urate (males)	0.23 – 0.46 mmol/L
Serum urate (females)	0.19 – 0.36 mmol/L
Plasma lactate	0.6 – 1.8 mmol/L
Plasma ammonia	12 – 55 µmol/L
Serum angiotensin-converting enzyme	25 – 82 U/L
Fasting plasma glucose	3.0 – 6.0 mmol/L
Haemoglobin A <sub>1</sub> C	3.8 – 6.4%
Fructosamine	< 285 µmo/L
Serum amylase	60 – 180 U/L
Plasma osmolality	278 – 305 mosmol/Kg

## Urine

<u>Albumin/creatinine ratio (untimed specimen)</u>	<3.5 mg/mmol (males) <2.5 mg/mmol (females)
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## Lipids and Lipoproteins

The target levels will vary depending on the patient's overall cardiovascular risk assessment.

Serum cholesterol:	< 5.2 mmol/L
Serum LDL cholesterol:	< 3.36 mmol/L
Serum HDL cholesterol:	> 1.55 mmol/L
Fasting serum triglyceride	0.45 – 1.69 mmol/L

## Blood Gases (breathing air at sea level)

Blood H <sup>+</sup>	35 – 45 nmol/L
pH	7.36 – 7.44
P <sub>a</sub> O <sub>2</sub>	11.3 – 12.6 kP <sub>a</sub>
P <sub>a</sub> CO <sub>2</sub>	4.7 – 6.0 kP <sub>a</sub>
Base excess	± 2 mmol/L
Carboxyhaemoglobin:	
Non-smoker	< 2%
Smoker	3 – 15%

## Endocrinology

### Adrenal steroids

#### Blood

#### Serum aldosterone (normal diet)

<u>Upright (4h)</u>	<u>330 – 830 pmol/L</u>
<u>Supine (30m)</u>	<u>135 – 400 pmol/L</u>

#### Serum cortisol:

<u>09.00h</u>	<u>200 – 700 nmol/L</u>
<u>22.00h</u>	<u>50 – 250 nmol/L</u>

#### Overnight dexamethasone suppression test (after 1mg dexamethasone)

<u>Serum cortisol</u>	<u>&lt; 50 nmol/l</u>
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#### Low dose dexamethasone suppression test (2 mg/day for 48h)

<u>Serum cortisol</u>	<u>&lt; 50 nmol/L</u>
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#### After insulin-induced hypoglycaemia (blood glucose < 2.2 mmol/L)

<u>Serum cortisol</u>	<u>&gt; 550 nmol/L and 200 nmol/L greater than baseline</u>
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<u>Plasma 11 – deoxycortisol</u>	<u>24 – 46 nmol/L</u>
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#### Serum dehydroepiandrosterone

<u>(09.00)</u>	<u>7 – 31 nmol/L</u>
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#### Serum dehydroepiandrosterone sulphate:

<u>(Males)</u>	<u>2 – 10 µmol/L</u>
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<u>(Females)</u>	<u>3 – 12 µmol/L</u>
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#### Serum androstenedione (adults)

<u>Males</u>	<u>1.6 – 8.4 nmol/L</u>
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<u>Females</u>	<u>0.6 – 8.8 nmol/L</u>
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<u>Post menopausal females</u>	<u>0.9 – 6.8 nmol/L</u>
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#### Serum 17-hydroxyprogesterone:

<u>Males</u>	<u>1 – 10 nmol/L</u>
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#### Females

<u>Follicular</u>	<u>1 – 10 nmol/L</u>
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<u>Luteal</u>	<u>10 – 20 nmol/L</u>
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#### Serum oestradiol

<u>Males</u>	<u>&lt; 180 pmol/L</u>
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#### Females

<u>Post-menopausal</u>	<u>&lt; 100 pmol/L</u>
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<u>Follicular</u>	<u>200 – 400 pmol/L</u>
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<u>Mid-cycle</u>	<u>400 – 1200 pmol/L</u>
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<u>Luteal</u>	<u>400 – 1000 pmol/L</u>
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#### Serum progesterone

<u>Males</u>	<u>&lt; 6 nmol/L</u>
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#### Females

<u>Follicular</u>	<u>&lt; 10 nmol/L</u>
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<u>Luteal</u>	<u>&gt; 30 nmol/L</u>
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#### Serum testosterone

<u>Males</u>	<u>9 – 35 nmol/L</u>
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<u>Females</u>	<u>0.5 – 3 nmol/L</u>
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#### Serum dihydrotestosterone

<u>Males</u>	<u>1- 2.6 nmol/L</u>
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<u>Females</u>	<u>0.3 – 9.3 nmol/L</u>
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#### Serum sex hormone binding protein

<u>Males</u>	<u>10 – 62 nmol/L</u>
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<u>Females</u>	<u>40 – 137 nmol/L</u>
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## Urine

<u>Aldosterone</u>	<u>14 – 53 nmol/24h</u>
<u>Cortisol</u>	<u>55 – 250 nmol/24h</u>

<u>Plasma angiotensin II</u>	<u>5 – 35 pmol/L</u>
<u>Plasma renin activity</u>	
<u>Recumbent</u>	<u>1.1 – 2.7 pmol/ml/h</u>
<u>Erect after 30m</u>	<u>3.0 – 4.3 pmol/ml/h</u>

## Pancreatic and gut hormones

<u>Plasma gastrin</u>	<u>&lt; 55 pmol/L</u>
<u>Plasma or serum insulin:</u>	
<u>Overnight fasting</u>	<u>&lt; 186 pmol/L</u>
<u>After hypoglycaemia</u>	
<u>(Blood glucose &lt; 2.2 mmol/L)</u>	<u>&lt; 21 pmol/L</u>
<u>Plasma vasoactive intestinal polypeptide</u>	<u>&lt; 30 pmol/L</u>
<u>Plasma pancreatic polypeptide</u>	<u>&lt; 300 pmol/L</u>
<u>Plasma glucagon</u>	<u>&lt; 50 pmol/L</u>

## Anterior pituitary hormones

<u>Plasma adrenocorticotrophic hormone</u>	
<u>09.00</u>	<u>&lt; 18 pmol/L</u>
<u>Plasma follicle stimulating hormone</u>	
<u>Males</u>	<u>1 – 7 U/L</u>
<u>Females</u>	
<u>Follicular</u>	<u>2.5 – 10 U/L</u>
<u>Midcycle</u>	<u>25 – 70 U/L</u>
<u>Luteal</u>	<u>0.32 – 2.1 U/L</u>
<u>Post-menopausal</u>	<u>&gt; 30 U/L</u>
<u>Plasma growth hormone</u>	
<u>Basal, fasting and between pulses</u>	<u>&lt; 1 mU/L</u>
<u>After hypoglycaemia</u>	<u>&gt; 40 mU/L</u>
<u>Plasma luteinizing hormone</u>	
<u>Males</u>	<u>1 – 10 U/L</u>
<u>Females</u>	
<u>Follicular</u>	<u>2.5 – 10 U/L</u>
<u>Midcycle</u>	<u>25 – 70 U/L</u>
<u>Luteal</u>	<u>1 – 13 U/L</u>
<u>Post-menopausal</u>	<u>&gt; 30 U/L</u>
<u>Plasma prolactin</u>	<u>&lt; 360 mU/L</u>
<u>Plasma thyroid stimulating hormone</u>	<u>0.4 – 5 mU/L</u>

## Posterior pituitary hormones

<u>Plasma antidiuretic hormone</u>	<u>0.9 – 4.6 pmol/L</u>
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### Thyroid hormones

Plasma thyroid binding globulin	13 – 28 mg/L
Plasma thyroxine (T4)	58 – 174 nmol/L
Free T4	10 – 22 pmol/L
Tri-iodothyronine (T3)	1.07 – 3.18 nmol/L
Free T3	5 – 10 pmol/L
Serum TSH receptor antibodies	< 7 U/L
Serum antithyroid peroxidase	< 50 IU/mL
Serum thyroid receptor antibodies	< 10 U/L

### Catecholamines

(Plasma recumbent with venous catheter in place for 30m prior to collection of sample)

Adrenaline	0.03 – 1.31 nmol/L
Noradrenaline	0.47 – 4.14 nmol/L

### Urine

Vanillyl mandelic acid	5 – 35 µmol/24h
Dopamine	< 3100 nmol/24h
Adrenaline	< 144 nmol/24h
Noradrenaline	< 570 nmol/24h
Hydroxyindole acetic acid	< 70 µmol/24h

### Others

Plasma parathyroid hormone	0.9 – 5.4 pmol/L
Plasma calcitonin	< 27 pmol/L
Serum cholecalciferol (vitamin D <sub>3</sub> )	60 – 105 nmol/L
Serum 25 – OH – cholecalciferol	45 – 90 nmol/L

### Age-related insulin like growth factor – 1

13 – 15 yrs	9.3 – 56.0 nmol/L
16 – 18 yrs	9.3 – 56.0 nmol/L
20 – 40 yrs	7.5 – 37.3 nmol/L
40 – 60 yrs	5.6 – 23.3 nmol/L
>60 yrs	3.3 – 23.3 nmol/L

## Immunology / Rheumatology

<u>Complement C3</u>	65 – 190 mg/dL
<u>Complement C4</u>	15 – 50 mg/dL
<u>Total haemolytic (CH<sub>50</sub>)</u>	150 – 250 U/L
<u>Serum C-reactive protein</u>	< 10 mg/L
<u>Serum immunoglobins</u>	
<u>IgG</u>	6.0 – 13.0 g/L
<u>IgA</u>	0.8 – 3.0 g/L
<u>IgM</u>	0.4 – 2.5 g/L
<u>IgE</u>	<120 kU/L
<u>Serum <math>\beta_2</math> – micro globulin</u>	< 3 mg/L
<u>Autoantibodies (all serum)</u>	
Adrenal	Negative at 1:10 Dil.
Anticentromere antibodies	Negative at 1:40 Dil.
Anticardiolipin antibody	
IgG	0 – 23
IgM	0 - 11
Anti double-stranded DNA (ELISA)	0 – 73 U/mL
Antineutrophil cytoplasmic antibodies	
Anti Proteinase 3	Negative
Anti MPO	Negative
Antinuclear antibodies	Negative at 1:20 Dil.
ENA	Negative
Gastric parietal cells	Negative at 1:20 Dil.
Interstitial cells of testis	Negative at 1:10 Dil.
Jo-1	Negative
La	Negative
Mitochondrial	Negative at 1:20 Dil.
RNP	Negative
Scl-70	Negative
Ro	Negative
Skeletal muscle	Negative at 1:60 Dil.
Sm	Negative
Smooth muscle	Negative at 1:20 Dil.
Thyroid colloid and microcosmal antigens	Negative at 1:10 Dil.
Rheumatoid factor	< 30 k IU/L

## Tumour Markers

<u>Serum alpha-fetoprotein</u>	<10 kU/L
<u>Serum carcinoembryonic antigen</u>	< 10 $\mu$ g/L
<u>Serum neurone specific enolase</u>	< 12 $\mu$ g/L
<u>Serum prostate specific antigen</u>	
Males over 40	<4 $\mu$ g/L
Males under 40	<2 $\mu$ g/L
<u>Serum human chorionic gonadotrophin</u>	< 5 U/L
<u>Serum CA 125</u>	< 35 U/mL
<u>Serum CA 19 – 9</u>	< 33 U/mL

## Therapeutic Drug Levels

Plasma aminophylline	10 – 20 µg/mL
Plasma carbamazepine	34 – 51 µmol/L
Blood ciclosporin	100 – 150 nmol/L
Plasma digoxin (taken at least 6h post dose)	1 – 2 nmol/L
Plasma ethosuximide	280 – 710 µmol/L
Blood gentamicin (peak)	5 – 7 µg/ml
Serum lithium	0.5 – 1.5 mmol/L
Serum phenobarbital	65 – 172 µmol/L
Serum phenytoin	40 – 80 µmol/L
Serum primidone	23 – 55 µmol/L
Plasma theophylline	55 – 110 µmol/L

## Cerebro-spinal fluid

Opening pressure	50 – 180 mm H <sub>2</sub> O
Total protein	0.15 – 0.45 g/L
Albumin	0.066 – 0.442 g/L
Chloride	116 – 122 mmol/L
Glucose	3.3 – 4.4 mmol/L
Lactate	1 – 2 mmol/L
Cell count	≤ 5 mL <sup>-1</sup>
Differential:	
Lymphocytes	60 – 70%
Monocytes	30 – 50%
Neutrophils	None
IgG/ALB	≤ 0.26
IgG index	≤ 0.88

## Urine

Glomerular filtration rate	70 – 140 mL/min
Total protein	< 0.2g/24h
Albumin	< 30 mg/24 h
Calcium	2.5 – 7.5 mmol/24h
Urobilinogen	1.7 – 5.9 µmol/24h
Coproporphyrin	< 300 nmol/24h
Uroporphyrin	6 – 24 nmol/24h
Delta-aminolevulinate	8 – 53 µmol/24h
5-hydroxyindoleacetic acid	10 – 47 µmol/24h
Osmolality	350 – 1000 mosmol/Kg

## Faeces

Nitrogen	70 – 140 mmol/24h
Urobilinogen	50 – 500 µmol/24h
Coproporphyrin	0.018 – 1.2 µmol/24h
Coproporphyrin	0.46 mmol/g dry weight
Protoporphyrin	0 – 4 µmol/24h
Protoporphyrin	0 – 220 nmol/g dry weight
Total porphyrin	
(ether soluble)	10 – 200 nmol/g dry weight
(ether insoluble)	0 – 24 nmol/g dry weight
Fat (on normal diet)	< 7g / 24h