DIAGNOSTIC TESTS
STANDARD CHEMISTRY & BASIC HAEMATOLOGY

Test Profile	Range RR	Interpretation of Results	
		↑ Increased ↑	↓ Decreased ↓
Albumin	34-50 g/l	Dehydration	Chronic liver disease (decreased synthesis), nephrotic syndrome, protein-losing enteropathy or extensive burns. Malabsorption or malnutrition may also cause hypo-albuminaemia.
Alkaline Phosphatase		Obstructive liver disease and bone disease.	
ALT (alanine transaminase)	0-45 U/l	Liver disease, particularly hepatocellular damage. High levels in toxic and viral hepatitis and acute circulatory failure. Moderately increased in cirrhosis, cholestasis and infectious mononucleosis. Also increased in myopathy. Isolated slightly raised ALT may be found with obesity and chronic hepatitis.	
AST (aspartate transaminase)	0-41 U/l	Following myocardial infarction and in viral or toxic hepatitis, modest elevation is found with cholestasis, alcoholism, hepatic malignancy, chronic hepatitis, some skeletal muscle diseases and after muscle trauma.	
Bilirubin	Less than 20 µmol/l	Hepatic dysfunction, biliary obstruction or excessive red cell turnover. Mildly elevated in Gilbert's syndrome. Also markedly elevated in the first few days of life but should fall rapidly within 5 days. Premature infants may show a more persistent elevation.	
Calcium	2.1-2.6 mmol/l (slightly higher in children under 5 years)	Hyperparathyroidism, myeloma, bone metastases, parathormone or parathormone related peptide producing neoplasms, Vit D excess and sarcoidosis.	Hypoparathyroidism, Vit D deficiency and hypomagnesaemia. Low values also found from hypo-albuminaemia.
Creatinine	45-120 µmol/l values vary greatly for infants and children.	Raised in renal failure. More sensitive indicator of early failure than blood urea. Value for monitoring after renal transplant.	Reduced muscle mass or low protein diet.
ESR Erythrocyte Sedimentation Rate	0-10mm/hour (Westergren method)	Pyrexial conditions, inflammatory diseases (including collagen diseases) and malignancies. Early indicator of disease. Normal values increase over 50 years (females more than males) and during pregnancy.	Falls more slowly during recovery than the C-Reactive Protein (CRP).
GGT (Gamma GT)	Male: 0-60 U/l Female: 0-40 U/l	Very sensitive indicator of liver damage, and of alcohol abuse. Also obesity, cardiac failure, diabetes, pancreatitis and malignancies. Levels may be raised by drugs which are enzyme inducers.	
Globulin	16-37 g/l	Chronic liver disease, chronic inflammatory and auto-immune disease and paraproteinaemias.	Nephrotic syndrome, malnutrition and hypogammaglobulinaeamia.
Glucose	Fasting: 2.8-5.8 mmol/l Random: 2.8-8.9 mmol/l (See note) ➔	Diabetes mellitus and some adrenal, thyroid and pituitary disorders. NB: AT 2 HOURS AFTER FOOD THE BLOOD GLUCOSE SHOULD NOT EXCEED 8.0 mmol/l (Europe 70-115)	Insulin excess (iatrogenic or insulinoma) and in some inherited metabolic disorders, particularly glycogen storage disease.

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Test Profile	Range RR	Interpretation of Results	
		↑ Increased ↑	↓ Decreased ↓
Haemoglobin	Adults: Male: 13.2-17.0 g/dl Female: 11.5-15.5 g/dl Children: <1 yr.: 10.5-13.5 g/dl 2-6 yrs: 11.5-14.0 g/dl 7-12 yrs: 11.5-14.5 g/dl	Hydration, tourniquet left on too long or clots in the sample may influence accuracy of result and in particular serial assessment.	
Haemoglobin	Adults: Male: 13.2-17.0 g/dl Female: 11.5-15.5 g/dl Children: <1 yr.: 10.5-13.5 g/dl 2-6 yrs: 11.5-14.0 g/dl 7-12 yrs: 11.5-14.5 g/dl	Accuracy of result and in particular serial assessment may be influenced by hydration, tourniquet left on too long or clots in the sample.	
HCT (PCV) Haematocrit	Male: 0.4-0.54 Female: 0.37-0.47	Polycythaemia and in haemoconcentration due to dehydration.	Anaemia and overhydration.
HCT (PCV)	Male: 0.4-0.54 Female: 0.37-0.47	Polycythaemia and in haemoconcentration due to dehydration.	Anaemia and overhydration.
MCH Mean Cell Haemoglobin	27-33 pg		Iron deficiency anaemia and the thalassaemias.
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MCHC Mean Cell Haemoglobin Vol.	32-36 g/dl	Increased values may be seen in the presence of spherocytes and sickle cells.	Iron deficiency anaemia, slightly reduced in some thalassaemias.
MCHC	32-36 g/dl	Increased values may be seen in the presence of spherocytes and sickle cells.	Iron deficiency anaemia, slightly reduced in some thalassaemias.
MCV Mean Cell Volume	80-98 fl	Macrocytic anaemias. Haemolytic anaemias, post-haemorrhage and in liver disease - especially associated with increased alcohol intake.	Thalassaemias and mycrocytic anaemia.
MCV	80-98 fl	Macrocytic anaemias. Haemolytic anaemias, post-haemorrhage and in liver disease - especially associated with increased alcohol intake.	Thalassaemias and mycrocytic anaemia.
Phosphate	0.8-1.4 mmol/l (higher values in children under 15 years: 1.29-1.78 mmol/l)	May be low in primary and secondary hyperparathyroidism and Vit D deficiency. Raised in renal failure and hypoparathyroidism. NB: results best interpreted together with calcium, albumin, alkaline phosphatase and creatinine levels.	
Platelet Count	150-400x10^9/l	Chronic haemorrhage, essential thrombocythaemia, vasculitides and post-splenectomy.	Malignancies, cytotoxic chemotherapy, auto-immune thrombocytopenia, DIC, splenomegaly and multi-transfused patients.

Test Profile	Range RR	Interpretation of Results	
		↑ Increased ↑	↓ Decreased ↓
RBC Red blood cells	Male: 4.2-5.8x10^12/l Female: 3.8-5.4x10^12/l	Reduced after haemorrhage (not immediately), haemolysis and in various anaemias. Polycythaemia and also in the thalassaemia traits, helping to distinguish these from iron deficiency.	
Triglycerides	<2.0 mmol/l	Familial pre-beta hyperlipidaemia, familial combined hyperlipidaemia, familial lipoprotein lipase deficiency, familial type V hyperlipidaemia, familial dyslipidaemia and secondary hyperlipidaemia (e.g. diabetes, obesity alcoholism etc.)	
Urate	Male: 180-450 µmol/l Female: 165 -350 µmol/l	Raised in gout. Renal failure, alcohol excess, high purine dietary intake, acute leukaemias, polycythaemia vera and in cytotoxic chemotherapy or radiotherapy.	
Urea	2.5-7.0 mmol/l (age up to 54) 2.5-8.4 (age over 54 years)	Increases with age. Renal dysfunction, dehydration, high protein diet and excess protein catabolism.	Pregnancy, starvation and hepatocellular failure.
WBC. White Blood Cell and differential	3.8-11.0x10^9/l	Bacterial infection, leukaemias, polycythaemia, exercise (including an epileptic seizure), later stages of pregnancy and trauma.	Some viral infections, drug therapy, aplastic anaemias and in idiopathic neutropenias.
LIPID SCREEN			
HDL-cholesterol High Density Lipoprotein	0.8-1.9 mmol/l Female 0.9-2.2 mmol/l More than 20% of total cholesterol is optimal		Low levels of HDL cholesterol predispose to coronary and peripheral arterial disease.
LDL- Low Density calculated	<4.0 mmol/l Borderline area: 4.0-4.9 mmol/l	Increased risk of atherosclerosis. Calculated from HDL and measured total cholesterol.	
COAGULATION SCREEN			
Activated partial prothrombin time (APTT)	26-38 secs	APTT prolonged in liver disease, coagulation factor deficiencies, especially haemophilia and Christmas disease (and sometimes in von Willebrand's disease), with circulating anticoagulants (such as Lupus Anticoagulant) and in anticoagulant therapy (especially i.v. heparin).	
Fibrinogen (if indicated)	2.0-4.0 g/l	Increased in inflammatory conditions. Risk factor in coronary artery disease.	Assayed in acute haemorrhagic episode in which DIC is suspected, when the level may be markedly decreased. Also reduced in congenital abnormalities of fibrinogen.
Prothrombin time (PT)	12-16 secs.	PT is prolonged by oral anticoagulant therapy, liver disease, malabsorption, DIC and congenital Factor deficiencies.	
Thrombin time	10-15 secs.	Prolonged in heparin therapy, fibrinogen deficiency, disseminated intravascular coagulation (DIC), liver disease and in the presence of FDPs (XDPs).	

HAEMATINIC PROFILE **NB: A reticulocyte count is recommended 5-7 days after the start of treatment, to detect early response.**			
Test Profile	**Range RR**	**Interpretation of Results**	
		↑ Increased ↑	**↓ Decreased ↓**
Saturation (%)	20-50		
Serum B12	200-11--ng/l	B12 therapy, myeloproliferative syndromes and (rarely) in primary hepatic carcinoma.	Pernicious anaemia and certain malnutrition/malabsorption states.
Serum ferritin	Male: 30-250 ng/ml Female: 30-80 ng/ml Post-menopausal: 30-175 ng/ml	Iron overload from any cause and in many malignant and inflammatory conditions.	Iron deficiency.
Serum iron (preferably fasting)	10-30 µmol/l	Excessive iron intake, haemolytic anaemias and haemochromatosis.	Iron deficiency anaemia, infections and malignancy.
TIBC Total Iron Binding Capacity	45-70µmol/l	Liver damage, haemolytic anaemias, excessive iron intake, haemochromatosis and in iron deficiency.	Acute and chronic infections and nephrotic syndrome.

BIOCHEMISTRY - STANDARD CHEMISTRY			
Test Profile	**Range RR**	**Interpretation of Results**	
		↑ Increased ↑	**↓ Decreased ↓**
Albumin	34-50 g/l	Dehydration	Chronic liver disease (decreased synthesis), nephrotic syndrome, protein-losing enteropathy or extensive burns. Malabsorption or malnutrition may also cause hypo-albuminaemia.
Alkaline Phosphatase		Obstructive liver disease and bone disease.	
ALT (alanine transaminase)	0-45 U/l	Liver disease, particularly hepatocellular damage. High levels in toxic and viral hepatitis and acute circulatory failure. Moderately increased in cirrhosis, cholestasis and infectious mononucleosis. Also increased in myopathy. Isolated slightly raised ALT may be found with obesity and chronic hepatitis.	
AST (aspartate transaminase)	0-41 U/l	Following myocardial infarction and in viral or toxic hepatitis, modest elevation is found with cholestasis, alcoholism, hepatic malignancy, chronic hepatitis, some skeletal muscle diseases and after muscle trauma.	
Bilirubin	Less than 20 µmol/l	Hepatic dysfunction, biliary obstruction or excessive red cell turnover. Mildly elevated in Gilbert's syndrome. Also markedly elevated in the first few days of life but should fall rapidly within 5 days. Premature infants may show a more persistent elevation.	
Calcium	2.1-2.6 mmol/l (slightly higher in children under 5 years)	Hyperparathyroidism, myeloma, bone metastases, parathormone or parathormone related peptide producing neoplasms, Vit D excess and sarcoidosis.	Hypoparathyroidism, Vit D deficiency and hypomagnesaemia. Low values also found from hypo-albuminaemia.
Cholesterol	5.2 mmol/l	Hyperlipidaemia, esp types IIa, IIb, III, (IV) Obstructive Jaundice, Alcoholic hepatitis, Nephrotic syndrome, myxoedema	Hyperthyroidism, pernicious anaemia, Malnutrition, abetalipoproteinaemia
Creatinine	45-120 µmol/l values vary greatly for infants and children.	Raised in renal failure. More sensitive indicator of early failure than blood urea. Value for monitoring after renal transplant.	Reduced muscle mass or low protein diet.
GGT Gamma-Glutamyl transpeptidase	Male: 0-60 U/l Female: 0-40 U/l	Very sensitive indicator of liver damage, and of alcohol abuse. Also obesity, cardiac failure, diabetes, pancreatitis and malignancies. Levels may be raised by drugs which are enzyme inducers.	
Globulin	16-37 g/l	Chronic liver disease, chronic inflammatory and auto-immune disease and paraproteinaemias.	Nephrotic syndrome, malnutrition and hypogammaglobulinaeamia
Glucose	Fasting: 2.8-5.8 mmol/l Random: 2.8-8.9 mmol/l NB: AT 2 HOURS AFTER FOOD THE BLOOD GLUCOSE SHOULD NOT EXCEED 8.0 mmol/l	Diabetes mellitus and some adrenal, thyroid and pituitary disorders.	Insulin excess (iatrogenic or insulinoma) and in some inherited metabolic disorders, particularly glycogen storage disease.

Phosphate	0.8-1.4 mmol/l (higher values in children under 15 years: 1.29-1.78 mmol/l)	May be low in primary and secondary hyperparathyroidism and Vit D deficiency. Raised in renal failure and hypoparathyroidism. NB: results best interpreted together with calcium, albumin, alkaline phosphatase and creatinine levels.	
Triglycerides	<2.0 mmol/l	Familial pre-beta hyperlipidaemia, familial combined hyperlipidaemia, familial lipoprotein lipase deficiency, familial type V hyperlipideaemia, familial dyslipidaemia and secondary hyperlipidaemia (e.g. diabetes, obesity alcoholism etc.)	
Urate	Male: 180-450 µmol/l Female: 165 -350 µmol/l	Raised in gout. Renal failure, alcohol excess, high purine dietary intake, acute leukaemias, polycythaemia vera and in cytotoxic chemotherapy or radiotherapy.	
Urea	2.5-7.0 mmol/l (age up to 54) 2.5-8.4 (age over 54 years)	Increases with age. Renal dysfunction, dehydration, high protein diet and excess protein catabolism.	Pregnancy, starvation and hepatocellular failure.

LIVER FUNCTION TESTS			
Test Profile	**Range RR**	**Interpretation of Results**	
		↑ Increased ↑	**↓ Decreased ↓**
Albumin	34-50 g/l	Dehydration	Chronic liver disease (decreased synthesis), nephrotic syndrome, protein-losing enteropathy or extensive burns. Malabsorption or malnutrition may also cause hypo-albuminaemia.
Alkaline Phosphatase		Obstructive liver disease and bone disease.	
ALT (alanine transaminase)	0-45 U/l	Liver disease, particularly hepatocellular damage. High levels in toxic and viral hepatitis and acute circulatory failure. Moderately increased in cirrhosis, cholestasis and infectious mononucleosis. Also increased in myopathy. Isolated slightly raised ALT may be found with obesity and chronic hepatitis.	
AST (aspartate transaminase)	0-41 U/l	Following myocardial infarction and in viral or toxic hepatitis, modest elevation is found with cholestasis, alcoholism, hepatic malignancy, chronic hepatitis, some skeletal muscle diseases and after muscle trauma.	
Bilirubin	Less than 20 µmol/l	Hepatic dysfunction, biliary obstruction or excessive red cell turnover. Mildly elevated in Gilbert's syndrome. Also markedly elevated in the first few days of life but should fall rapidly within 5 days. Premature infants may show a more persistent elevation.	
Globulin	16-37 g/l	Chronic liver disease, chronic inflammatory and auto-immune disease and paraproteinaemias.	Nephrotic syndrome, malnutrition and hypogammaglobulinaeamia.

ENDOCRINOLOGY

THYROID PROFILE

Test Profile	Range RR	Interpretation of Results	
		↑ Increased ↑	↓ Decreased ↓
Free T_4	9.4-24 pmol/l	Hyperthyroidism. NB: Useful in determining thyroid status in patients with an abnormal TBG levels e.g. pregnancy, oestrogen or androgen therapy, on the contraceptive pill or a congenitally abnormal TBG level.	Hypothyroidism
TSH	0.3-3.5 mU/l	Hypothyroidism (due to primary thyroid failure). A sensitive index of hypothyroidism and may be raised before thyroxine is abnormally low.	
HIRSUITISM PROFILE			
Free androgen index (FAI)			
Sex-hormone binding globulin (SHBG)	Male: 10-50 nmol/l Female: 30-90 nmol/l	Pregnancy, hyperthyroidism and in subjects on oral contraceptives.	Found in hirsute women and is a valuable investigation in this condition.
Testosterone	Male: 10-35 nmol/l Female: Pre-menopausal: 0.7-2.8 nmol/l Post-menopausal: 0.3-1.2 nmol/l	High levels in females may indicate an adrenorcortical tumour, androgen-secreting ovarian tumour or pituitary overproduction of ACTH.	Male infertility due to hypogonadism.
FERTILITY PROFILE (MALE)			
Follicle stimulating hormone (FSH) (Blood)	Male: 1.0-9.0 U/l Female: Follicular phase: 1.1-9.6 U/l Mid-cycle peak: 2.3-21 U/l Luteal phase: 0.8-7.5 U/l Post-menopausal: 20-96 U/l	Very high levels found after puberty in primary gonadal failure and in the menopause. Useful, with the luteinising hormone, in the investigation of infertility or hypogonadism in both sexes and amenorrhoea in women.	
Luteinising hormone (LH) (Blood)	Male: 85-858 mU/hour Female: 85-1500 mU/hour (excluding mid-cycle peak	Raised in primary gonadal failure. Used in evaluation of infertility, amenorrhoea, hypogonadism and failure to ovulate.	
Prolactin	Male: less than 250 mU/l Female: less than 400 mU/l	Most usual cause of a raised prolactin level (apart from pregnancy, lactation, hypothyroidism and phenothiazine drugs) is a pituitary (micro-) adenoma. NB: the stress of venepuncture may induce mild hyperprolactinaemia.	
Sex-hormone binding globulin (SHBG)	Male: 10-50 nmol/l Female: 30-90 nmol/l	Pregnancy, hyperthyroidism and in subjects on oral contraceptives.	Found in hirsute women and is a valuable investigation in this condition.
Testosterone	Male: 10-35 nmol/l Female: Pre-menopausal: 0.7-2.8 nmol/l Post-menopausal: 0.3-1.2 nmol/l	High levels in females may indicate an adrenorcortical tumour, androgen-secreting ovarian tumour or pituitary overproduction of ACTH.	Male infertility due to hypogonadism.

IMPOTENCE PROFILE			
Test Profile	**Range RR**	**Interpretation of Results**	
		↑ Increased ↑	**↓ Decreased ↓**
Free androgen index (FAI)			
Luteinising hormone (LH) (Blood)	Male: 85-858 mU/hour Female: 85-1500 mU/hour (excluding mid-cycle peak	Raised in primary gonadal failure. Used in evaluation of infertility, amenorrhoea, hypogonadism and failure to ovulate.	
Prolactin	Male: less than 250 mU/l Female: less than 400 mU/l	Most usual cause of a raised prolactin level (apart from pregnancy, lactation, hypothyroidism and phenothiazine drugs) is a pituitary (micro-) adenoma. NB: the stress of venepuncture may induce mild hyperprolactinaemia.	
Sex-hormone binding globulin (SHBG)	Male: 10-50 nmol/l Female: 30-90 nmol/l	Pregnancy, hyperthoidism and in subjects on oral contraceptives.	Found in hirsute women and is a valuable investigation in this condition.
Testosterone	Male: 10-35 nmol/l Female: Pre-menopausal: 0.7-2.8 nmol/l Post-menopausal: 0.3-1.2 nmol/l	High levels in females may indicate an adrenorcortical tumour, androgen-secreting ovarian tumour or pituitary overproduction of ACTH.	Male infertility due to hypogonadism.