

Reference Ranges Document


- Coagulation Laboratory
- Hematology Laboratory
- Clinical Chemistry Laboratory
- Immunology Laboratory
- Metabolic Laboratory

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	Pathology and Laboratory Medicine	Revised 4/17/2024
	Laboratory Reference Ranges	

ROUTINE COAGULATION TESTING REFERENCE RANGES

Test	Reference Range	Test	Therapeutic Range
PT	11.1-13.4 seconds	Low Molecular Weight Heparin	0.50-1.00 IU/mL
PTT*	25.0-37.0 seconds		
PTT Post Hepzyme	22.0-36.0 seconds		
Fibrinogen	131-405 mg/dL	Unfractionated Heparin	0.30-0.70 IU/mL
D-dimer	< 0.5 µg/mL FEU		
ATIII	87-145%	Direct Thrombin Inhibitor, Bivalirudin	60-90 seconds
ISI	1.010		
Geometric Mean	12.1		

** PT and PTT ranges for ages < 6 months:
Values change rapidly in the neonatal period and are dependent on the gestational age at delivery. Consult Nathan D., Oski F., Hematology of Infancy and Childhood, 4th edition, p118, or consult Hematology.*

SPECIAL COAGULATION TESTING REFERENCE RANGES

For all ages > 6 months:

Test	Reference Range
DRVVT Confirmation	0.0-1.2
DRVVT Screen	30.30-44.56 seconds
DRVVT Check	30.66-36.48 seconds
Thrombin Time	18.7-25.5 seconds
Protein C	81-150%
Protein S, functional	61-140%
Protein S, free	69.8-153.4%
Inhibitor Screen	Negative
Factor VIII Inhibitor	< 1 BU/ml
Chromogenic FVIII Inhibitor	< 1 BU/ml
Factor IX Inhibitors	< 1 BU/ml
vWF Activity	47-151%
vWF Antigen	35-197%

PLM Laboratory Reference Ranges

FACTOR ASSAYS

Factor	> 6 months to 17 years old	> 17 years old
Factor II	87-141%	89-156%
Factor V	60-138%	76-162%
Factor VII	57-139%	70-170%
Factor VIII	49-191%	56-179%
Factor IX	52-112%	71-153%
Factor X	73-128%	75-149%
Factor XI	63-142%	60-136%
Factor XII	40-162%	41-165%
Factor XIII*	49-150%	49-150%

** In-house pediatric reference ranges have not been established for this assay. The listed reference range is based upon an adult population; published pediatric ranges are available (Toulon P et al, Thromb Haemost 2016;116:9-16 or Nathan & Oski, Hematology of Infancy and Childhood, 4th Ed).*

PLM Laboratory Reference Ranges

GENERAL CHEMISTRY REFERENCE RANGES

ALBUMIN (g/dL)

Age	Male	Female
0-5 days	2.6-3.6	2.6-3.6
6-29 days	2.8-4.0	2.8-4.0
1-6 months	3.1-4.2	3.1-4.2
7-11 months	3.3-4.3	3.3-4.3
1-3 years	3.5-4.6	3.5-4.6
4-6 years	3.5-5.2	3.5-5.2
7-19 years	3.7-5.6	3.7-5.6
≥ 20 years	3.5-5.0	3.5-5.0

ALKALINE PHOSPHATASE (U/L)

Age	Male	Female
1-29 days	70-300	70-300
1-11 months	70-345	70-345
1-3 years	145-320	145-320
4-6 years	150-380	150-380
7-9 years	175-420	175-420
10-11 years	135-530	130-560
12-13 years	200-495	105-420
14-15 years	130-525	70-230
16-20 years	65-260	50-130
≥ 21 years	38-126	38-126

ALANINE AMINOTRANSFERASE, ALT (U/L)

Age	Male	Female
0-<1 year	5-45	5-45
1-12 years	10-30	10-30
13-18 years	10-35	10-26
≥ 19 years	<50	<35

AMMONIA, NH₃ (μmol/L)

Age	Male	Female
All ages	9-33	9-33

AMYLASE (U/L)

Age	Male	Female
0-89 days	0-30	0-30
3-5 months	0-50	0-50
6-11 months	0-80	0-80
1-18 years	30-100	30-100
≥ 19 years	30-110	30-110

ASO TITER (IU/mL)

Age	Male	Female
Children	0-150	0-150
Adults	0-200	0-200

ASPARTATE AMINOTRANSFERASE, AST (U/L)

Age	Male	Female
1-7 days	30-140	30-140
8-30 days	22-71	22-71
1-11 months	20-64	20-64
1-3 years	20-60	20-60
4-6 years	15-50	15-50
7-9 years	15-40	15-40
10-11 years	10-60	10-40
12-15 years	15-40	10-30
16-18 years	15-45	5-30
≥ 19 years	17-59	14-36

BILIRUBIN, CONJUGATED (mg/dL)

Age	Male	Female
All ages	0.0-0.3	0.0-0.3

BETA-HYDROXYBUTYRATE, BHB (mmol/L)

Age	Male	Female
1-6 years	0.0-1.0	0.0-1.0
7-14 years	0.0-0.9	0.0-0.9
≥ 15 years	0.0-0.3	0.0-0.3

BILIRUBIN, UNCONJUGATED (mg/dL)

Age	Male	Female
0d-20 years	0.2-1.0	0.2-1.0
≥ 21 years	0.0-1.1	0.0-1.1

BUN (mg/dL)

Age	Male	Female
0d-2 years	2-19	2-19
3-12 years	5-17	5-17
13-18 years	7-18	7-18
19-20 years	8-21	8-21
≥ 21 years	9-20	7-17

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CALCIUM (mg/dL)

Age	Male	Female
0-90 days	7.8-11.3	7.8-11.3
91-180 days	8.8-11.2	8.8-11.2
181-364 days	8.8-11.4	8.8-11.4
1-3 years	8.8-11.1	8.8-11.1
4-11 years	8.8-10.7	8.8-10.7
12-19 years	8.5-10.6	8.5-10.6
≥ 19 years	8.5-10.5	8.5-10.5

CHOLESTEROL (mg/dL)

Age	Male	Female
0d-5 years	45-182	45-182
6-8 years	109-189	109-189
9-10 years	112-248	112-248
11-12 years	126-231	176-243
13-14 years	127-230	126-214
15-18 years	107-225	130-215
≥ 18 years	111-220	107-217

CREATINE KINASE, CK (U/L)

Age	Male	Female
1-3 years	60-305	60-305
4-6 years	75-230	75-230
7-9 years	60-365	60-365
10-11 years	55-215	80-230
12-13 years	60-330	50-295
14-17 years	60-335	50-240
18-20 years	55-370	45-230
≥ 21 years	55-170	30-135

CK-MB (U/L)

CK-MB is positive for MI when the following criteria are met:

1. Total CK > 65 U/L
2. "Peak" CK-MB >16 U/L
3. %MB at "Peak" between 4% - 25% of total CK

CHLORIDE, CL (mmol/L)

Age	Male	Female
0d-9 years	96-106	96-106
10-20 years	98-106	98-106
≥ 21 years	98-107	98-107

CO₂ (mmol/L)

Age	Male	Female
0d-20 years	20-26	20-26
≥ 21 years	22-30	22-30

CREATININE (mg/dL)

Age	Male	Female
0d-5 years	0.1-0.4	0.1-0.4
6-8 years	0.1-0.5	0.1-0.5
9-12 years	0.2-0.5	0.2-0.5
13-18 years	0.3-0.8	0.3-0.8
19-20 years	0.4-1.0	0.4-1.0
≥ 21 years	0.7-1.3	0.5-1.0

C-REACTIVE PROTEIN, CRP (mg/dL)

Age	Male	Female
All ages	< 1.0	< 1.0

CSF GLUCOSE (mg/dL)

Age	Male	Female
All ages	32-82	32-82

CSF LACTATE (mmol/L)

Age	Male	Female
All ages	0.0-3.3	0.0-3.3

CSF TOTAL PROTEIN (mg/dL)

Age	Male	Female
0-30 days	40-120	40-120
1m-1m30d	20-70	20-70
≥ 2 months	15-40	15-40

Cystatin C (mg/L)

Age	Male	Female
0-18 years	0.51-1.05	0.51-1.05

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Gamma-glutamyl transferase, GGT (U/L)

Age	Male	Female
1-30 days	25-168	25-168
1-6 months	17-126	17-126
7-11 months	10-42	10-42
1-6 years	5-16	5-16
7-9 years	11-21	11-21
10-11 years	14-25	14-23
12-13 years	14-37	12-21
14-15 years	10-28	12-22
16-20 years	9-29	9-23
≥ 21 years	13-61	10-36

GLUCOSE (mg/dL)

Age	Male	Female
0d-6 years	74-127	74-127
7-17 years	70-106	70-106
≥ 18 years	75-110	65-105

GLUCOSE, OB Tolerance Test (mg/dL)

Tube	Female
Fasting	65-94
1 Hour	65-179
2 Hour	65-154
3 Hour	65-139

HAPTOGLOBIN (mg/dL)

Age	Male	Female
All ages	30-200	30-200

Hemoglobin A1c, HbA1c (%)

Age	Male	Female
All ages	3.8-5.9	3.8-5.9

HDL CHOLESTEROL (mg/dL)

Age	Male	Female
0d-12 years	35-82	35-82
13-18 years	36-84	36-84
≥ 19 years	35-65	35-65

IRON (ug/dL)

Age	Male	Female
0d-20 years	25-140	25-140
≥ 21 years	49-181	37-170

LACTATE, plasma (mmol/L)

Age	Male	Female
0d-20 years	0.6-2.0	0.6-2.0
≥ 21 years	0.7-2.1	0.7-2.1

LACTATE DEHYDROGENASE, LDH (U/L)

Age	Male	Female
0d-<2 years	200-874	
2-<7 years	200-386	
7-<13 years	162-324	
≥ 13 years	146-316	

LDL CHOLESTEROL (mg/dL)

Age	Male	Female
5-9 years	63-129	68-140
10-14 years	64-133	68-136
15-18 years	62-130	59-137
≥ 19 years	68-130	59-137

LIPASE (U/L)

Age	Male	Female
0d-11 months	10-115	10-115
1-3 years	15-130	15-130
4-9 years	25-120	25-120
10-13 years	15-110	15-110
14-20 years	25-110	25-110
≥ 21 years	23-300	23-300

MAGNESIUM (mg/dL)

Age	Male	Female
0d-20 years	1.5-2.5	1.5-2.5
≥ 21 years	1.6-2.3	1.6-2.3

PHOSPHOROUS, PO₄ (mg/dL)

Age	Male	Female
0d-11 months	4.8-8.2	4.8-8.2
1-3 years	3.8-6.5	3.8-6.5
4-6 years	4.1-5.4	4.1-5.4
7-11 years	3.7-5.6	3.7-5.6
12-13 years	3.3-5.4	3.3-5.4
14-15 years	2.9-5.4	2.9-5.4
16-20 years	2.7-4.7	2.7-4.7
≥ 21 years	2.5-4.5	2.5-4.5

PLASMA HEMOGLOBIN (mg/dL)

Age	Male	Female
All ages	< 30	< 30

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POTASSIUM, K (mmol/L)

Age	Male	Female
0d-9 years	4.1-5.8	4.1-5.8
10-20 years	3.8-5.4	3.8-5.4
≥ 21 years	3.6-5.0	3.6-5.0

PRE-ALBUMIN (mg/dL)

Age	Male	Female
0d-11 months	6.0-21.0	6.0-21.0
1-5 years	14.0-30.0	14.0-30.0
6-9 years	15.0-33.0	15.0-33.0
10-13 years	20.0-36.0	20.0-36.0
≥ 14 years	22.0-45.0	22.0-45.0

PROCALCITONIN (ng/mL)

Age	Male	Female
All ages	0.00-0.10	0.00-0.10

SODIUM, NA (mmol/L)

Age	Male	Female
0d-11 months	133-140	133-140
1-9 years	138-145	138-145
10-20 years	136-145	136-145
≥ 21 years	137-145	137-145

TOTAL BILIRUBIN (mg/dL)

Age	Male	Female
0d-20 years	0.6-1.4	0.6-1.4
≥ 21 years	0.2-1.3	0.2-1.3

TRANSFERRIN (mg/dL)

Age	Male	Female
All ages	180-370	180-370

TRANSFERRIN SATURATION (%)

Age	Male	Female
All ages	6.0-40.0	6.0-40.0

TOTAL IRON BINDING CAPACITY, TIBC (µg/dL)

Age	Male	Female
All ages	250-520	250-520

TOTAL PROTEIN (g/dL)

Age	Male	Female
0d-2 years	5.4-7.0	5.4-7.0
3-5 years	5.9-7.0	5.9-7.0
6-8 years	5.9-7.8	5.9-7.8
9-18 years	6.2-8.1	6.2-8.1
19-20 years	6.3-8.6	6.3-8.6
≥ 21 years	6.3-8.2	6.3-8.2

TRIGLYCERIDES (mg/dL)

Age	Male	Female
0d-5 years	27-125	27-125
6-8 years	32-116	32-116
9-10 years	28-129	28-129
11-12 years	24-137	39-140
13-14 years	24-145	37-130
15-18 years	34-165	38-135
≥ 19 years	34-140	37-140

URIC ACID (mg/dL)

Age	Male	Female
0-30 days	1.3-4.9	1.4-6.2
1-5 months	1.4-5.5	1.4-5.5
6-11 months	1.4-6.3	1.4-6.3
1-3 years	1.8-5.0	1.8-5.0
4-6 years	2.2-4.7	2.2-4.7
7-9 years	2.0-5.0	2.0-5.0
10-11 years	2.3-5.4	3.0-4.7
12-13 years	2.7-6.7	3.0-5.8
14-15 years	2.4-7.8	3.0-5.8
≥ 16 years	4.0-8.6	3.0-5.9

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ENDOCRINOLOGY REFERENCE RANGES

ACTH (pg/mL)

Age	Male	Female
0d-9 years	5-46	5-46
10-18 years	6-55	6-55
≥ 19 years	7-69	6-58

ALPHA-FETOPROTEIN, AFP (ng/mL)

Age	Male	Female
0-30 days	0.6-16,387	0.6-18,964
1-11 months	0.6-28.3	0.6-77.0
1-3 years	0.6-7.9	0.6-11.1
4-6 years	0.6-5.6	0.6-4.2
7-12 years	0.6-3.7	0.6-5.6
13-20 years	0.6-3.9	0.6-4.2
≥ 21 years	0.0-8.9	0.0-8.9

ANTI-THYROGLOBULIN (IU/mL)

Age	Male	Female
All ages	0.0-40.0	0.0-40.0

ANTI-THYROID PEROXIDASE Ab (IU/mL)

Age	Male	Female
All ages	0-35	0-35

B12, VITAMIN (pg/mL)

Age	Male	Female
0d-1 year	293-1208	228-1514
2-3 years	264-1216	416-1209
4-6 years	245-1078	313-1407
7-9 years	271-1170	247-1174
10-12 years	183-1088	197-1019
13-17 years	214-865	182-820
≥ 18 years	199-732	199-732

C-PEPTIDE (ng/mL)

Age	Male	Female
0-9 years	0.0-3.3	0.0-3.3
10-16 years	0.4-3.3	0.4-3.3
≥ 17 years	1.1-5.0	1.1-5.0

CORTISOL, AM (µg/dL)

Age	Male	Female
All ages	3.7-19.4	3.7-19.4

CORTISOL, PM (µg/dL)

Age	Male	Female
All ages	2.9-17.3	2.9-17.3

FERRITIN (ng/mL)

Age	Male	Female
4-14 days	99.6-717	99.6-717
15d-6 months	14.0-647.2	14.0-647.2
6m-1 year	10.0-181.9	10.0-181.9
1-5 years	10.0-99.9	10.0-99.9
5-14 years	13.7-78.8	13.7-78.8
14-16 years	12.7-82.8	10.0-67.4
16-19 years	11.1-171.9	10.0-67.4
≥ 19 years	21.81-274.66	10.0-204

FOLATE (ng/mL)

Age	Male	Female
0d-1 year	7.2-22.4	6.3-22.7
2-3 years	2.5-15.0	1.7-15.7
4-6 years	0.5-13.0	2.7-14.1
7-9 years	2.3-11.9	2.4-13.4
10-12 years	1.5-10.8	1.0-10.2
13-17 years	1.2-8.8	1.2-7.2
≥ 18 years	2.8-13.5	2.8-13.0

FOLLICLE STIMULATING HORMONE, FSH (mIU/mL)

Age	Male	Age	Female
1-9 years	0-5.3	1-2 years	0-8.8
10-11 years	0-6.5	3-8 years	0-5.3
13-18 years	0-11.1	9-11 years	0-11.1
		12-18 year	0-16.9

FREE T4 (ng/dL)

Age	Male	Female
5-14 days	1.05-3.21	1.05-3.21
15-29 days	0.68-2.53	0.68-2.53
30 day - <1 year	0.89-1.7	0.89-1.7
1 - <19 years	0.89-1.37	0.89-1.37
≥ 19 years	0.70-1.48	0.70-1.48

FREE THYROXINE INDEX (µg/dL)

Age	Male	Female
All ages	1.3-5.5	1.3-5.5

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GROWTH HORMONE (ng/mL)

Measurement of hGH in a single "fasting" blood sample is not an appropriate method for testing deficiency; provocative stimulation is required. Random samples have little diagnostic value except in the newborn. Neonates usually have tonically elevated hGH values and a low value is suggestive but not diagnostic of GHD. On the other hand a high value is compatible with GH normalcy.

INSULIN (µIU/mL)

Collection	Male	Female
Fasting	2.0-20.0	2.0-20.0
Hypoglycemia	< 2.0	<2.0

INTACT PTH (pg/mL)

Age	Male	Female
All ages	12-65	12-65

LUTEINIZING HORMONE, LH (mIU/mL)

Age	Male	Female
0-7 days	1.5-5.0	1.5-5.0
2w-1 year	By 2 weeks: 3.0-22.0 <i>Increases by 2 weeks to 3.0-22.0. Declines to prepubertal levels by 1 year.</i>	By 2 weeks: 1.8-13.0 <i>Increases by 2 weeks to 1.8-13.0. Declines to prepubertal levels by 1 year.</i>
Prepubertal children	1.0-3.5	1.0-3.5
Pubertal children	Rise to Adult Values 3.0-10.0	Rise to Adult Values <i>Follicular (3.0-11.0) Mid-cycle (18.0-70.0) Luteal (1.0-11.0)</i>

PROLACTIN (ng/mL)

Age	Male	Age	Female
2m-2 years	2.0-25.0	0 - 1m	1.0-90.0
2-6 years	1.0-16.0	1m-2y	2.0-20.0
6-10 years	2.0-11.0	2-6y	1.0-18.0
10-18 year	2.0-14.0	6-10y	2.0-12.0
Adults	4.0-18.0	10-18y	3.0-18.0
		Adults	3.0-19.0

T3 UPTAKE (%)

Age	Male	Female
All ages	24.0-35.0	24.0-35.0

THYROID STIMULATING HORMONE, TSH (µIU/mL)

Age	Male	Female
0-3 days	0.7-16.0	0.7-16.0
4d-6 months	0.7-4.8	0.7-4.8
6m-14 years	0.7-4.2	0.7-4.2
14-19 years	0.5-3.4	0.5-3.4

TOTAL T3 (ng/mL)

Age	Male	Female
0-3 days	0.9-2.8	0.9-2.8
4-30 days	0.6-2.3	0.6-2.3
1-23 months	0.8-2.7	0.8-2.7
2-6 years	0.8-2.4	0.8-2.4
7-11 years	0.9-2.1	0.9-2.1
12-19 years	0.8-2.1	0.8-2.1
≥ 20 years	0.7-1.9	0.7-1.9

TOTAL T4 (µg/dL)

Age	Male	Female
0-2 days	8.0-19.3	8.0-19.3
3-30 days	5.2-14.6	5.2-14.6
1-11 months	6.1-13.7	6.1-13.7
1-5 years	4.7-10.8	4.7-10.8
≥ 6 years	4.7-9.9	4.7-9.9

PLM Laboratory Reference Ranges

TOTAL β -hCG (mIU/mL)

Male and non-pregnant females: < 5 mIU/mL
 Pregnant female: As early as 1-week post conception, HCG is detected. The reference value for a positive pregnancy test is 25 mIU/mL. The levels of HCG increases exponentially for about 8-10 weeks after the last menstrual cycle and the levels begin to fall.

KEPPRA ($\mu\text{g/mL}$)

Age	Male	Female
All ages	12.0-46.0	12.0-46.0

LIDOCAINE ($\mu\text{g/mL}$)

Age	Male	Female
All ages	1.5-5.0	1.5-5.0

LITHIUM (mmol/L)

Age	Male	Female
All ages	0.6-1.2	0.6-1.2

THERAPEUTIC DRUG REFERENCE RANGES

ACETAMINOPHEN ($\mu\text{g/mL}$)

Age	Male	Female
All ages	10.0-20.0	10.0-20.0

AMIKACIN, PEAK ($\mu\text{g/mL}$)

Age	Male	Female
All ages	20.0-30.0	20.0-30.0

AMIKACIN, TROUGH ($\mu\text{g/mL}$)

Age	Male	Female
All ages	0.0-10.0	0.0-10.0

CARBAMEZEPINE ($\mu\text{g/mL}$)

Single Dg Reg: 8.0-12.0
 Double Dg Reg: 4.0-8.0

CYCLOSPORINE ($\mu\text{g/L}$)

Age	Male	Female
All ages	150-400	150-400

DIGOXIN (ng/mL)

Age	Male	Female
All ages	0.5-2.0	0.5-2.0

GENTAMICIN, PEAK ($\mu\text{g/mL}$)

Age	Male	Female
All ages	4.0-12.0	4.0-12.0

GENTAMICIN, TROUGH ($\mu\text{g/mL}$)

Age	Male	Female
All ages	< 2.0	< 2.0

METHOTREXATE ($\mu\text{mol/L}$)

Infant all (level drawn hr 6 & 8 of infusion)
 CSF: 10 $\mu\text{mol/L}$
 Serum: 0.08 $\mu\text{mol/L}$

Osteogenic Sarcoma (Upper limit of normal)
 24 hr: 10 $\mu\text{mol/L}$
 48 hr: 1 $\mu\text{mol/L}$
 72 hr: 0.1 $\mu\text{mol/L}$

Osteogenic Sarcoma (at the end of 4 hr infusion)
 Serum: 1000 $\mu\text{mol/L}$

PHENOBARBITAL ($\mu\text{g/mL}$)

Age	Male	Female
All ages	15-40	15-40

PHENYTOIN ($\mu\text{g/mL}$)

Age	Male	Female
All ages	10.0-20.0	10.0-20.0

PLM Laboratory Reference Ranges

RAPAMYCIN (µg/L)

Age	Male	Female
All ages	4.0-12.0	4.0-12.0

The stated therapeutic range is based on a trough specimen collected within 1 hour of the AM Rapamycin dose with the patient in the maintenance phase, and Sirolimus in combination with Cyclosporine for a kidney transplant. The range may vary with other transplant organs when used in combination with other drugs other than Cyclosporine (or Sirolimus alone), with the approach of the transplant center and other factors.

SALICYLATES (mg/dL)

Age	Male	Female
All ages	30.0-35.0	30.0-35.0

TACROLIMUS (ng/mL)

Age	Male	Female
All ages	5.0-20.0	5.0-20.0

TOBRAMYCIN, PEAK (µg/mL)

Age	Male	Female
All ages	4-12	4-12

TOBRAMYCIN, TROUGH (µg/mL)

Age	Male	Female
All ages	< 2.0	< 2.0

VALPROIC ACID (µg/mL)

Age	Male	Female
All ages	50-100	50-100

VANCOMYCIN, PEAK (µg/mL)

Age	Male	Female
All ages	20.0-30.0	20.0-30.0

VANCOMYCIN, TROUGH (µg/mL)

Age	Male	Female
All ages	3.0-20.0	3.0-20.0

**TOXICOLOGY / DRUGS OF ABUSE
REFERENCE RANGES**

ETHANOL (g/dL)

Age	Male	Female
All ages	None Detected	None Detected

TRICYCLIC ANTIDEPRESSANTS (ng/mL)

Age	Male	Female
All ages	Negative	Negative

URINE DRUG SCREEN

Drug	Cut-off (ng/mL)	Male	Female
Amphetamine	500	Negative	
Barbiturate	200	Negative	
Benzodiazepines	200	Negative	
Cannabinoids	50	Negative	
Cocaine	300	Negative	
Methadone	150	Negative	
Opiates	300	Negative	
Oxycodone	100	Negative	
Phencyclidine	25	Negative	

PLM Laboratory Reference Ranges

BLOOD GAS REFERENCE RANGES

pH, arterial

Age	Male	Female
0 Days	7.27-7.47	7.27-7.47
0-1 day	7.29-7.45	7.29-7.45
2-30 days	7.31-7.45	7.31-7.45
1m-1 year	7.34-7.44	7.34-7.44
2-18 years	7.37-7.44	7.37-7.44
≥ 19 years	7.35-7.45	7.35-7.45

pH, venous

Age	Male	Female
All ages	7.32-7.42	7.32-7.42

pO₂, arterial (mmHg)

Age	Male	Female
0-1 day	55-106	55-106
1-6 days	54-95	54-95
7-30 days	65-98	65-98
1m-1 year	80-105	80-105
2-18 years	83-108	83-108
19-20 years	87-112	87-112
≥ 21 years	75-100	75-100

pO₂, venous (mmHg)

Age	Male	Female
All ages	25-47	25-47

pCO₂, arterial (mmHg)

Age	Male	Female
0-1 day	29-45	29-45
1-6 days	27-40	27-40
7-30 days	30-42	30-42
1m-1 year	30-44	30-44
2-18 years	31-47	31-47
19-20 years	31-48	31-48
≥ 21 years	35-45	35-45

pCO₂, venous (mmHg)

Age	Male	Female
All ages	40-50	40-50

O₂ Saturation, arterial (%)

Age	Male	Female
0-1 day	85-90	85-90
1-6 days	94-99	94-99
7-30 days	92-99	92-99
1m-18 years	95-99	95-99
≥ 19 years	94-99	94-99

O₂ Saturation, venous (%)

Age	Male	Female
All ages	60-85	60-85

Base Excess (mmol/L)

Age	Male	Female
1-6 days	-9.0 to -2.0	-9.0 to -2.0
7-30 days	-6.5 to -0.5	-6.5 to -0.5
1m-1 year	-5.5 to -0.5	-5.5 to 0.5
2-18 years	-4.0 to 2.0	-4.0 to 2.0
≥ 19 years	-3.0 to 3.0	-3.0 to 3.0

Total CO₂, calculated (mmol/L)

Age	Male	Female
1-6 days	17-24	17-24
7-30 days	19-25	19-25
1m-1 year	19-26	19-26
2-8 years	21-27	21-27
>19 years	23-28	23-28

HCO₃⁻, arterial (mmol/L)

Age	Male	Female
0-6 days	16.5-22.5	16.5-22.5
1-4 weeks	18.0-24.0	18.0-24.0
1-12 months	18.0-25.0	18.0-25.0
1-18 years	20.0-26.0	20.0-26.0
19-20 years	22.0-27.0	22.0-27.0
≥ 21 years	21.0-29.0	21.0-29.0

HCO₃⁻, venous (mmol/L)

Age	Male	Female
All ages	22.0-26.0	22.0-26.0

PLM Laboratory Reference Ranges

Sodium, whole blood (mmol/L)

Age	Male	Female
0d-2 months	132-142	132-142
3m-14 years	136-142	136-142
≥ 15 years	135-145	135-145

Potassium, whole blood (mmol/L)

Age	Male	Female
0-1 day	5.0-7.5	5.0-7.5
2d-2 months	4.0-6.2	4.0-6.2
3m-14 years	3.8-5.0	3.8-5.0
≥ 15 years	3.5-5.5	3.5-5.5

Chloride, whole blood (mmol/L)

Age	Male	Female
0 days	96-104	96-104
1 day	97-110	97-110
2d-20 years	98-106	98-106
≥ 21 years	98-107	98-107

Ionized Calcium (mmol/L)

Age	Male	Female
0 days	1.07-1.27	1.07-1.27
1d-1 year	1.00-1.17	1.00-1.17
2-4 years	1.21-1.37	1.21-1.37
5-17 years	1.15-1.34	1.15-1.34
≥ 18 years	1.12-1.30	1.12-1.30

Total Hemoglobin (g/dL)

Age	Male	Female
0d-11 months	11.0-20.0	11.0-20.0
1 year	10.0-15.0	10.0-15.0
2-15 years	11.0-16.0	11.0-16.0
≥ 16 years	14.0-18.0	12.0-16.0

Hematocrit, calculated (%)

Age	Male	Female
0 days	42-60	42-60
1-30 days	45-65	45-65
1-2 months	31-55	31-55
3-5 months	29-41	29-41
6m-1 year	33-39	33-39
2-5 years	34-40	34-40
6-11 years	35-45	35-45
12-17 years	37-49	36-46
≥ 18 years	41-52	36-46

Oxyhemoglobin, O₂Hb (%)

Age	Male	Female
All ages	95-99	95-99

Carboxyhemoglobin, COHb (%)

Age	Male	Female
All ages	0-2	0-2

Methmemoglobin, MetHb (%)

Age	Male	Female
0d-14 years	0.0-2.8	0.0-2.8
≥ 15 years	0.0-1.9	0.0-1.9

Oxygen Content, calculated (mL/dL)

Age	Male	Female
All ages	15-23	15-23

Glucose, whole blood (mg/dL)

Age	Male	Female
0d-1 year	58-121	58-121
2-4 years	67-121	67-121
5-7 years	65-121	65-121
8-11 years	64-125	64-125
12-13 years	69-124	69-124
14-16 years	72-135	72-135
≥ 17 years	60-115	60-115

Lactate, whole blood, arterial (mmol/L)

Age	Male	Female
All ages	0.5-1.6	0.5-1.6

Lactate, whole blood, venous (mmol/L)

Age	Male	Female
All ages	0.5-2.2	0.5-2.2

Osmolality, plasma (mOsm/kg)

Age	Male	Female
All ages	275-296	275-296

Osmolality, urine (mOsm/kg)

Age	Male	Female
0d-1 year	50-645	50-645
≥ 2 years	50-1,500	50-1,500

Osmolality, body fluid (mOsm/kg)

Age	Male	Female
All ages	No ranges	No ranges

PLM Laboratory Reference Ranges

URINE CHEMISTRY REFERENCE RANGES

URINE AMYLASE (U/L)

Age	Male	Female
<i>No Ranges Available</i>		

URINE BUN (mg/dL)

Age	Male	Female
<i>No Ranges Available</i>		

URINE CALCIUM, RANDOM (mg/dL)

Age	Male	Female
<i>No Ranges Available</i>		

URINE CALCIUM, TIMED (mg/24 hours)

Age	Male	Female
0-1 week	< 2 mg/24 hour	
Children	10-25 mg/24 hour	
>=18 years	50-400 mg/24 hour, usually < 4 mg/kg/24 hour	

URINE CA/CREA RATIO (mg/mg)

Age	Male	Female
< 7 months	0.07-0.86	
7-18 months	0.07-0.60	
18m-6 years	0.03-0.42	
Adults	0.05-0.22	

URINE CHLORIDE (mmol/L)

Age	Male	Female
<i>No Ranges Available</i>		

URINE CREATININE, RANDOM (mg/dL)

Age	Male	Female
<i>No Ranges Available</i>		

URINE CREATININE, TIMED (mg/kg/24 hours)

Age	Male	Female
Pre-mature	8.3-19.9	8.3-19.9
Term	10.0-15.5	10.0-15.5
6-11 years	6.4-21.9	6.4-21.9
12-17 years	20.7-28.2	12.2-39.4

URINE CREATININE CLEARANCE (mL/min/1.73m²)

Age	Male	Female
≤ 30 days	40-65	40-65
1-6 months	55	55
7-11 months	78	78
1-1.5 years	100	100
2-12 years	110-125	110-125

GLOMERULAR FILTRATION RATE (mL/min)

Kidney Disease Stage	Reference Range
Stage 1	≥ 90 mL/min/1.73m ² , and structural abnormalities
Stage 2	60-89 mL/min/1.73m ²
Stage 3	30-59 mL/min/1.73m ²
Stage 4	15-29 mL/min/1.73m ²
Stage 5	< 15 mL/min/1.73m ² or dialysis
<i>The MDRD equation cannot estimate GFR > 60 mL/min/1.73m² at this time.</i>	

URINE GLUCOSE (mg/dL)

Age	Male	Female
<i>No Ranges Available</i>		

URINE MAGNESIUM (mg/dL)

Age	Male	Female
<i>No Ranges Available</i>		

URINE MICRO-ALBUMIN, random (µg/mL)

Age	Male	Female
<18 years	0-30	
>= 18years	0-25	

URINE MICRO-ALBUMIN, 24 hours (mg/24 hours)

ADA Guidelines:	
< 30 mg/gm	Normal
30-299 mg/gm	Microalbuminuria
≥ 300 mg/gm	Clinical Albuminuria

PLM Laboratory Reference Ranges

URINE MICRO-ALBUMIN/CREA RATIO (mg/gm)

ADA Guidelines:	
< 30 mg/gm	Normal
30-299 mg/gm	Microalbuminuria
≥ 300 mg/gm	Clinical Albuminuria

URINE PHOSPHOROUS (mg/dL)

Age	Male	Female
<i>No Ranges Available</i>		

URINE POTASSIUM (mmol/L)

Age	Male	Female
<i>No Ranges Available</i>		
Usefulness will depend upon serum levels, EC volume, GFR, response to appropriate stimulus and prior use of diuretics.		

URINE SODIUM (mmol/L)

Age	Male	Female
<i>No Ranges Available</i>		
Usefulness will depend upon serum levels, EC volume, GFR, response to appropriate stimulus and prior use of diuretics.		

URINE TOTAL PROTEIN, RANDOM (mg/dL)

Age	Male	Female
<i>No Ranges Available</i>		

Urine PH

Age	Male	Female
0-4 Days	4.90-6.80	4.90-6.80
4-8 Days	5.70-7.40	5.70-7.40
8 Days-3 Weeks	5.50-7.40	5.50-7.40
3 Weeks-2 Months	5.30-6.60	5.30-6.60
2-3 Months	4.90-6.30	4.90-6.30
3-4 Months	5.40-6.60	5.40-6.60
4-5 Months	4.20-7.30	5.20-7.30
5-6 Months	5.00-5.40	5.00-5.40
6-7 Months	6.50-7.20	6.50-7.20
7 Months-2 Year	5.50-6.80	5.50-6.80
2-6 Years	5.30-6.70	5.30-6.70
6-12 Years	5.67-6.83	5.67-6.83
12-17 Years	5.23-5.90	5.23-5.90
≥17 Years	5.40-7.00	5.40-7.00

CARDIAC MARKER REFERENCE RANGES

BNP (pg/mL)

Age	Male	Female
All ages	≤ 100	≤ 100

HOMOCYSTEINE (µmol/L)

Age	Male	Female
< 5d	Reference ranges have not been established for <5 days of age	
≥ 5d - < 1y	2.87-9.99	
≥ 1y - < 7y	2.76-7.62	
≥ 7y - < 12y	3.43-8.45	
≥ 12y - < 15y	4.07-10.36	4.71-10.40
≥ 15y - < 19y	4.92-11.88	5.50-13.39
≥ 19y	5.08-15.39	

TROPONIN-I (ng/mL)

Age	Male	Female
All ages	< 0.3	< 0.3
Troponin-I is an early and late marker for acute myocardial infarction (increases above upper limit occur 3-8 hours post-infarction: Peak levels occur 8-24 hours after infarction; values return to normal within 4-8 days). The diagnostic cut-off for acute myocardial infarction (AMI) is 0.3 ng/mL. NEGATIVE FOR AMI: < 0.3 ng/mL POSITIVE FOR AMI: ≥ 0.3 ng/mL		

LEAD TESTING REFERENCE RANGES

LEAD (µg/dL)

Age	Male	Female
0-5 years	Normal Lead Concentration: < 3.5 µg/dL Critical Lead Concentration: > 35.0 µg/dL	
> 5 years	Normal Lead Concentration: < 5.0 µg/dL Critical Lead Concentration: > 35.0 µg/dL	

PLM Laboratory Reference Ranges

Interpretive comments are added based on lead concentration:

0-5 years	Normal: < 3.5 µg/dL
<p>No additional action unless exposure source change.</p> <p>Ref: THESE ARE NEW REFERENCE VALUES TO COMPLY WITH THE UPDATED GUIDELINES OF THE CDC ADVISORY COMMITTEE ON CHILDHOOD LEAD POISONING PREVENTION</p> <p>“This test was developed and its performance characteristics determined by The Children’s Hospital of Philadelphia Clinical Chemistry Laboratory. It has not been cleared or approved by the U.S. Food and Drug Administration (FDA). The FDA has determined that such clearance or approval is not necessary. This test is used for clinical purposes. It should not be regarded as investigational or for research. This laboratory is certified under the Clinical Laboratory Improvement amendments of 1988 (CLIA-88) as qualified to perform high-complexity clinical laboratory testing.”</p>	

0-5 years	Abnormal: 3.5-19.9 µg/dL
<p>Provide family lead education. Provide at least one follow-up test within three months. Refer to social services if necessary. Elevated results from non-certified lead free tubes may be due to contamination. Elevated levels</p> <p>of blood lead should be confirmed with a second specimen collected in metal-free tube (Tan K2EDTA).</p> <p>Ref: THESE ARE NEW REFERENCE VALUES TO COMPLY WITH THE UPDATED GUIDELINES OF THE CDC ADVISORY COMMITTEE ON CHILDHOOD LEAD POISONING PREVENTION</p> <p>“This test was developed and its performance characteristics determined by The Children’s Hospital of Philadelphia Clinical Chemistry Laboratory. It has not been cleared or approved by the U.S. Food and Drug Administration (FDA). The FDA has determined that such clearance or approval is not necessary. This test is used for clinical</p>	

purposes. It should not be regarded as investigational or for research. This laboratory is certified under the Clinical Laboratory Improvement amendments of 1988 (CLIA-88) as qualified to perform high-complexity clinical laboratory testing.”

> 5 years	Normal: < 5.0 µg/dL
<p>No additional action unless exposure source change.</p> <p>Ref: THESE ARE NEW REFERENCE VALUES TO COMPLY WITH THE UPDATED GUIDELINES OF THE CDC ADVISORY COMMITTEE ON CHILDHOOD LEAD POISONING PREVENTION</p> <p>“This test was developed and its performance characteristics determined by The Children’s Hospital of Philadelphia Clinical Chemistry Laboratory. It has not been cleared or approved by the U.S. Food and Drug Administration (FDA). The FDA has determined that such clearance or approval is not necessary. This test is used for clinical purposes. It should not be regarded as investigational or for research. This laboratory is certified under the Clinical Laboratory Improvement amendments of 1988 (CLIA-88) as qualified to perform high-complexity clinical laboratory testing.”</p>	

> 5 years	Abnormal: 5.0-19.9 µg/dL
<p>Provide family lead education. Provide at least one follow-up test within three months. Refer to social services if necessary. Elevated results from non-certified lead free tubes may be due to contamination. Elevated levels of blood lead should be confirmed with a second specimen collected in metal-free tube (Tan K2EDTA).</p> <p>Ref: THESE ARE NEW REFERENCE VALUES TO COMPLY WITH THE UPDATED GUIDELINES OF THE CDC ADVISORY COMMITTEE ON CHILDHOOD LEAD POISONING PREVENTION</p> <p>“This test was developed and its performance characteristics determined by The Children’s Hospital of Philadelphia Clinical Chemistry</p>	

PLM Laboratory Reference Ranges

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All ages	Abnormal: 45.0-59.9 µg/dL
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Provide coordination of care (case management). Provide clinical management. Provide environmental investigation. Provide Lead-Hazard control. Elevated results from non-certified lead free tubes may be due to contamination. Elevated levels of blood lead should be confirmed with a second specimen collected in metal-free tube (Tan K2EDTA).

Ref: THESE ARE NEW REFERENCE VALUES TO COMPLY WITH THE UPDATED GUIDELINES OF THE CDC ADVISORY COMMITTEE ON CHILDHOOD LEAD POISONING PREVENTION

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All ages	Abnormal: 20.0-44.9 µg/dL
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Provide family lead education. Provide at least one follow-up test within two months. Refer to social services if necessary. If blood level persists (i.e. two venous blood lead levels in this range at least three months apart) or increase, provide coordination of care (case management). Provide clinical management. Provide environmental investigation. Provide Lead-Hazard control. Elevated results from non-certified lead free tubes may be due to contamination. Elevated levels of blood lead should be confirmed with a second specimen collected in metal-free tube (Tan K2EDTA).

Ref: THESE ARE NEW REFERENCE VALUES TO COMPLY WITH THE UPDATED GUIDELINES OF THE CDC ADVISORY COMMITTEE ON CHILDHOOD LEAD POISONING PREVENTION
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All ages	Abnormal: 60.0-69.9 µg/dL
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Within 48 hours, begin coordination of care (case management). Provide clinical management. Provide environmental investigation. Provide Lead-Hazard control. Elevated results from non-certified lead free tubes may be due to contamination. Elevated levels of blood lead should be confirmed with a second specimen collected in metal-free tube (Tan K2EDTA).

Ref: THESE ARE NEW REFERENCE VALUES TO COMPLY WITH THE UPDATED GUIDELINES OF THE CDC ADVISORY COMMITTEE ON CHILDHOOD LEAD POISONING PREVENTION

PLM Laboratory Reference Ranges

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All ages	Abnormal: $\geq 70.0 \mu\text{g/dL}$
<p>This is a critical concentration. A second venous test, hospitalization, appropriate chelation therapy and removal from Lead exposure are urgently recommended. Elevated levels of blood lead should be confirmed with a second specimen collected in metal-free tube (Tan K2EDTA).</p>	
<p>Ref: THESE ARE NEW REFERENCE VALUES TO COMPLY WITH THE UPDATED GUIDELINES OF THE CDC ADVISORY COMMITTEE ON CHILDHOOD LEAD POISONING PREVENTION</p>	
<p>“This test was developed and its performance characteristics determined by The Children’s Hospital of Philadelphia Clinical Chemistry Laboratory. It has not been cleared or approved by the U.S. Food and Drug Administration (FDA). The FDA has determined that such clearance or approval is not necessary. This test is used for clinical purposes. It should not be regarded as investigational or for research. This laboratory is certified under the Clinical Laboratory Improvement amendments of 1988 (CLIA-88) as qualified to perform high-complexity clinical laboratory testing.”</p>	

SWEAT TESTING REFERENCE RANGES

Diagnostic ranges for sweat chloride values for all ages:

Sweat Chloride	Interpretation
< 30 mmol/L	Newborns with a positive newborn screen: Cystic Fibrosis is unlikely. Other populations: Cystic Fibrosis is unlikely
30 – 59 mmol/L	All populations: intermediate range – need further study to establish or rule out a CF diagnosis
$\geq 60 \text{ mmol/L}$	All populations: indicative of Cystic Fibrosis for individuals presenting with a positive newborn screen, clinical features consistent with CF, or a positive family history

Note:

Sweat chloride values < 30 mmol/L have been documented in genetically proven CF patients and CRMS/CFSPID individuals. Repeat testing may be indicated by family history or if symptoms suggestive of CF occur.

Patients with sweat chloride values in the intermediate range (30-59 mmol/L) on 2 separation occasions may have CF and should be considered for extended CFTR gene analysis and/or CFTR functional analysis.

All results need to be interpreted in relation to the patient's clinical status. Paired values (i.e. right arm vs left arm) should agree within 10 mmol/L for values < 60 mmol/L, and within 15 mmol/L for higher values. Sweat chloride values > 160 mmol/L are physiologically impossible.

Refer to the 2016 Consensus Guidelines from the Cystic Fibrosis Foundation for additional information.

Sweat collection volumes:

$\geq 15 \mu\text{L}$: Acceptable collection
< 15 μL : Unacceptable collection

PLM Laboratory Reference Ranges

VITAMIN D REFERENCE RANGES

Total 25-Hydroxy Vitamin D2 and D3 (25-OH VITD)

< 12 ng/mL	Deficiency
12-20 ng/mL	Insufficiency
> 20 ng/mL	Sufficiency*
> 100 ng/mL	Toxicity Possible

* These reference ranges represent clinical decision values for the prevention of rickets and osteomalacia in the pediatric population (1). While 20 ng/mL is deemed sufficient for bone health according to these guidelines, a concentration of 30 ng/mL or greater may be optimum for specific disease states or non-bone-related outcomes (2).

(1) Munns, et al. Global Consensus Recommendations on Prevention and Management of Nutritional Rickets. JCEM. 2016;101(2):394-415.

(2) Holick, et al. Evaluation, Treatment, and Prevention of Vitamin D Deficiency; an Endocrine Society Clinical Practice Guideline. JCEM. 2011;96(7):1911-1930.

VIROLOGY REFERENCE RANGES

ARCHITECT HIV COMBO AG/AB

Test	Result	Interpretation
HIV Combo Ag/Ab	<1.00 S/CO	NONREACTIVE

GEENIUS HIV ANTIBODIES

Test	Result
HIV CONFIRMATION	NEGATIVE

HEPATITIS B AG/AB

Test	Result	Interpretation
Hepatitis B Surface Antigen	<1.00 S/CO	NONREACTIVE
Hepatitis B Core IgM Antibody	<.80 S/CO	NONREACTIVE
Hepatitis B Core Total Antibody	<1.00 S/CO	NONREACTIVE

HEPATITIS B SURFACE ANTIBODY

Vaccination Status	Result	Interpretation
Vaccinated for Hepatitis B	≥ 12.00 mIU/mL	REACTIVE
Unvaccinated for Hepatitis B	≤8.00 mIU/mL	NONREACTIVE

HEPATITIS A

Test	Result	Interpretation
Hepatitis A IgG Antibody	<1.00 S/CO	NONREACTIVE
Hepatitis A IgM Antibody	< 0.80 S/CO	NONREACTIVE

HEPATITIS C

Test	Result	Interpretation
Hepatitis C Antibody	<0.80 S/CO	NONREACTIVE

PLM Laboratory Reference Ranges

CBC REFERENCE RANGES

WBC (10³/μL)

Age	Male	Female	Unknown
≤ 14 days	8.0-15.4	8.2-14.6	8.2-14.6
15-30 days	7.8-15.9	8.4-14.4	8.4-14.4
1-2 months	8.1-15.0	7.1-14.7	8.1-14.7
2-6 months	6.5-13.3	6.0-13.3	6.5-13.3
6-24 months	6.0-13.5	6.5-13.0	6.5-13.0
2-6 years	5.1-13.4	4.9-13.2	5.1-13.2
6-12 years	4.3-11.0	4.3-11.4	4.3-11.0
12-18 years	3.8-9.8	4.2-9.4	4.2-9.4
≥ 18 years	3.9-8.8	4.4-9.7	4.4-8.8

RBC (10⁶/μL)

Age	Male	Female	Unknown
≤ 3 days		3.90-6.60	
4-7 days		3.90-6.30	
8-14 days		3.60-6.20	
15-30 days		3.00-5.40	
1-2 months		2.70-4.90	
2-6 months		3.10-4.50	
6-24 months		3.70-5.30	
2-6 years		3.90-5.30	
6-12 years		4.00-5.20	
12-18 years	4.50-5.30	4.10-5.10	4.50-5.10
≥ 18 years	4.50-5.90	4.00-5.20	4.50-5.20

HEMOGLOBIN (g/dL)

Age	Male	Female	Unknown
≤ 3 days		13.5-22.5	
4-7 days		13.5-19.5	
8-14 days		12.5-20.5	
15-30 days		10.0-18.0	
1-2 months		9.0-13.5	
2-6 months		9.5-13.5	
6-24 months		10.5-13.5	
2-6 years		11.5-13.5	
6-12 years		11.5-15.5	
12-18 years	13.0-16.0	12.0-16.0	13.0-16.0
≥ 18 years	13.5-17.5	12.0-16.0	13.5-16.0

HEMATOCRIT (%)

Age	Male	Female	Unknown
≤ 3 days		42.0-67.0	
4-7 days		42.0-66.0	
8-14 days		39.0-63.0	
15-30 days		31.0-55.0	
1-2 months		28.0-42.0	
2-6 months		29.0-41.0	
6-24 months		33.0-39.0	
2-6 years		34.0-40.0	
6-12 years		35.0-45.0	
12-18 years	37.0-49.0	36.0-46.0	37.0-46.0
≥ 18 years	41.0-53.0	36.0-46.0	41.0-46.0

MCV (fL)

Age	Male	Female	Unknown
≤ 3 days		98-121	
4-7 days		88-126	
8-14 days		86-124	
15-30 days		85-123	
1-2 months		77-115	
2-6 months		74-108	
6-24 months		70-86	
2-6 years		75-87	
6-12 years		77-95	
12-18 years	78-98	78-102	78-98
≥ 18 years		80-100	

MCH (pg)

Age	Male	Female	Unknown
≤ 3 days		31-37	
4-30 days		28-40	
1-2 months		26-34	
2-6 months		25-35	
6-24 months		23-31	
2-6 years		24-30	
6-12 years		25-33	
12-18 years		25-35	
≥ 18 years		26-34	

MCHC (g/dL)

Age	Male	Female	Unknown
≤ 3 days		30-37	
4-14 days		28-38	
15 days – 2 months		29-37	
2-24 months		30-36	
≥ 2 years		31-37	

RDW-SD

Age	Male	Female	Unknown
≤ 14 days	51.0-61.7	51.4-65.7	51.4-61.7
15-30 days	46.3-57.3	47.2-59.8	47.2-57.3
1-2 months	43.9-52.8	43.0-55.0	43.9-52.8
2-6 months	35.3-45.7	35.2-45.7	35.3-45.7
6-24 months	35.3-42.8	34.9-42.4	35.3-42.4
2-6 years	35.1-41.7	34.9-42.0	35.1-41.7
6-12 years	35.1-41.7	25.5-41.8	35.1-41.7
12-18 years	36.7-43.8	37.1-44.2	37.1-43.8
≥ 18 years	37.8-46.1	38.4-47.7	38.4-46.1

RDW-CV

Age	Male	Female	Unknown
≤ 14 days	14.8-17.0	14.6-17.3	14.8-17.0
15-30 days	14.3-16.8	14.4-16.2	14.4-16.2
1-2 months	13.8-16.1	13.6-15.8	13.8-15.8
2-6 months	12.4-15.3	12.4-15.3	12.4-15.3
6-24 months	12.9-15.6	12.7-15.1	12.9-15.1
2-6 years	12.5-14.9	12.4-14.9	12.5-14.9
6-12 years	12.3-14.1	12.2-14.4	12.3-14.1
12-18 years	12.4-14.5	12.3-14.6	12.4-14.5
≥ 18 years	12.3-14.3	12.4-15.1	12.4-14.3

PLM Laboratory Reference Ranges

PLT (K/ μ L)

Age	Male	Female	Unknown
All ages		150-450	

MPV (fL)

Age	Male	Female	Unknown
≤ 14 days	10.2-11.9	10.4-12.0	10.4-11.9
15-30 days	10.1-12.1	10.0-12.2	10.1-12.1
1-2 months	9.2-10.8	9.4-11.1	9.4-10.8
2-6 months	8.9-10.6	9.0-10.9	9.0-10.6
6-24 months	8.7-10.5	8.8-10.6	8.8-10.5
2-6 years	8.8-10.6	8.9-11.0	8.9-10.6
6-12 years	9.2-11.4	9.3-11.3	9.3-11.4
12-18 years	9.6-11.8	9.6-11.7	9.6-11.7
≥ 18 years	9.7-11.9	9.6-12.0	9.7-11.9

IPF (%)

Age	Male	Female	Unknown
≤ 6 months	2.0-6.8	1.3-6.8	2.0-6.8
6-24 months	1.4-3.8	1.4-4.5	1.4-3.8
2-6 years	1.1-3.6	1.0-3.6	1.0-3.6
6-12 years	1.0-4.9	1.0-4.7	1.0-4.7
12-18 years	1.6-6.1	1.4-6.4	1.6-6.1
≥ 18 years	1.6-7.1	1.6-4.9	1.6-4.9

RETIC (%)

Age	Male	Female	Unknown
≤ 3 days		3.47-5.40	
4-30 days		1.06-2.37	
1-2 months		2.12-3.47	
2-6 months		1.55-2.70	
6-24 months		0.99-1.82	
2-6 years		0.82-1.45	
6-12 years		0.98-1.94	
12-18 years		0.90-1.49	
≥ 18 years		0.86-1.36	

ABSOLUTE RETIC ($10^3/\mu$ L)

Age	Male	Female	Unknown
≤ 3 days		147.5-216.4	
4-30 days		51.3-110.4	
1-2 months		51.8-77.9	
2-6 months		48.2-88.2	
6-24 months		43.5-111.1	
2-6 years		36.4-68.0	
6-12 years		42.4-70.2	
12-18 years		41.6-65.1	
≥ 18 years		39.1-57.0	

IMMATURE RETIC FRACTION (%)

Age	Male	Female	Unknown
≤ 3 days		30.5-35.1	
4-30 days		14.5-24.6	
1-2 months		19.1-28.9	
2-6 months		13.4-23.3	
6-24 months		11.4-25.8	
2-6 years		8.4-21.7	
6-12 years		8.9-24.1	
12-18 years		9.0-18.7	
≥ 18 years		9.3-17.4	

RETIC-HE (pg)

Age	Male	Female	Unknown
≤ 6 months	27.6-38.7	29.2-37.5	29.2-37.5
6-24 months	28.7-35.7	30.1-35.7	30.1-35.7
2-6 years	27.7-37.8	29.3-37.3	29.3-37.3
6-12 years	32.4-37.6	30.4-39.7	32.4-37.6
12-18 years	30.3-40.4	29.9-38.4	30.3-38.4
≥ 18 years	36.0-38.6	30.6-40.7	36.0-38.6

NRBC (/100 WBC)

Age	Male	Female	Unknown
≤ 3 days		0.1-8.3	
4 days - ≥ 18 years		0.0-0.0	

NRBC Absolute ($/\mu$ L)

Age	Male	Female	Unknown
≤ 3 days		0.06-1.30	
4-30 days		0.04-0.11	
31-60 days		0.03-0.09	
61-180 days		0.03-0.13	
6 months - < 2 years		0.03-0.12	
2 - < 6 years		0.03-0.32	
6 - < 12 years		0.03-0.15	
12 - < 18 years		0.03-0.13	
≥ 18 years		0.03-0.11	

DIFFERENTIAL REFERENCE RANGES

NEUTROPHILS (%)

Age	Male	Female	Unknown
≤ 14 days	20.2-46.2	15.2-66.1	20.2-46.2
15-30 days	14.0-54.6	10.6-57.3	14.0-54.6
1-2 months	10.2-48.7	8.9-68.2	10.2-48.7
2-6 months	10.9-47.8	14.1-76.0	14.1-47.8
6-24 months	17.5-69.5	16.9-74.0	17.5-69.5
2-6 years	22.4-69.0	22.4-69.0	22.4-69.0
6-12 years	28.6-74.5	29.8-71.4	29.8-71.4
12-18 years	32.5-74.7	29.8-71.4	32.5-71.4
≥ 18 years	40.3-74.8	42.5-73.2	42.5-73.2

ABSOLUTE NEUTROPHILS ($/\mu$ L)

Age	Male	Female	Unknown
≤ 14 days	1600-6060	1730-6750	1730-6060
15-30 days	1108-5450	1230-4800	1230-4800
1-2 months	830-4230	1000-4680	1000-4230
2-6 months	970-5450	1040-7200	1040-5450
6-24 months	1190-7210	1270-7180	1270-7180
2-6 years	1540-7920	1600-8290	1600-7920
6-12 years	1630-7550	1640-7870	1640-7550
12-18 years	1540-7040	1820-7470	1820-7040
≥ 18 years	1820-7420	2000-7150	2000-7150

PLM Laboratory Reference Ranges

LYMPHOCYTES (%)

Age	Male	Female	Unknown
≤ 14 days	33.7-67.6	24.9-68.5	33.7-67.6
15-30 days	33.6-76.8	31.9-82.7	33.6-76.8
1-2 months	42.5-85.7	37.8-86.7	42.5-85.7
2-6 months	40.7-86.7	30.4-85.6	40.7-85.6
6-24 months	26.0-79.6	27.4-79.9	26.0-79.6
2-6 years	18.4-66.6	18.1-68.6	18.4-66.6
6-12 years	15.5-56.6	16.7-57.8	16.7-56.6
12-18 years	16.4-52.7	18.2-49.8	18.2-49.8
≥ 18 years	12.2-47.1	18.2-47.4	18.2-47.1

EOSINOPHILS (%)

Age	Male	Female	Unknown
≤ 14 days	0.0-5.2	0.0-4.6	0.0-4.6
15-30 days		0.0-5.3	
1-2 months	0.0-4.5	0.0-4.1	0.0-4.1
2-6 months	0.0-4.0	0.0-3.6	0.0-3.6
6-24 months	0.0-3.7	0.0-3.2	0.0-3.2
2-6 years	0.0-4.1	0.0-3.3	0.0-3.3
6-12 years	0.0-4.7	0.0-4.0	0.0-4.0
12-18 years	0.0-4.0	0.0-3.4	0.0-3.4
≥ 18 years	0.0-4.4	0.0-3.0	0.0-3.0

ATYPICAL LYMPHOCYTES (%)

Age	Male	Female	Unknown
≤ 3 days		0.0-2.0	
4-7 days		0.0-4.0	
8-14 days	0.0-4.0	0.0-3.0	0.0-3.0
15-30 days	0.0-4.0	0.0-3.0	0.0-3.0
1-2 months		0.0-3.0	
2-6 months	0.0-3.0	0.0-4.0	0.0-3.0
6-24 months		0.0-4.0	
2-6 years		0.0-4.0	
6-12 years		0.0-3.0	
≥ 12 years		0.0-2.0	

ABSOLUTE EOSINOPHIL (/μL)

Age	Male	Female	Unknown
≤ 14 days	0-660	0-640	0-640
15-30 days	0-800	0-750	0-750
1-2 months	0-570	0-630	0-570
2-6 months	0-610	0-740	0-610
6-24 months	0-820	0-580	0-580
2-6 years	0-530	0-460	0-460
6-12 years	0-520	0-470	0-470
12-18 years	0-380	0-320	0-320
≥ 18 years	0-440	0-270	0-270

ABSOLUTE LYMPHOCYTES (/μL)

Age	Male	Female	Unknown
≤ 14 days	2070-7530	1750-8000	2070-7530
15-30 days	2110-8380	2420-8200	2420-8200
1-2 months	2470-7950	2290-9142	2470-7950
2-6 months	2140-8990	2140-8990	2140-8990
6-24 months	1560-7830	1520-8090	1560-7830
2-6 years	1130-5520	1250-5770	1250-5520
6-12 years	970-3960	1160-4280	1160-3960
12-18 years	970-3260	1160-3330	1160-3260
≥ 18 years	850-3000	1160-3180	1160-3000

BASOPHILS (%)

Age	Male	Female	Unknown
≤ 14 days	0.0-0.8	0.0-0.6	0.0-0.6
15-30 days	0.0-0.6	0.0-0.5	0.0-0.5
1-2 months	0.0-0.6	0.0-0.5	0.0-0.5
2 months – 6 years	0.0-0.6	0.0-0.6	0.0-0.6
6-12 years	0.0-0.7	0.0-0.6	0.0-0.6
12-18 years	0.0-0.7	0.0-0.6	0.0-0.6
≥ 18 years	0.0-0.7	0.0-0.7	0.0-0.7

MONOCYTES (%)

Age	Male	Female	Unknown
≤ 14 days	6.7-19.9	5.2-20.6	6.7-19.9
15-30 days	4.3-18.3	5.6-13.8	5.6-13.8
1-2 months	4.4-14.0	3.8-15.5	4.4-14.0
2-6 months	3.8-13.4	3.8-12.6	3.8-12.6
6-24 months	4.4-13.4	3.8-12.8	4.4-12.8
2-6 years	4.2-12.2	4.1-11.4	4.2-11.4
6-12 years	4.2-12.3	4.2-11.3	4.2-11.3
12-18 years	4.4-12.3	4.1-10.9	4.4-10.9
≥ 18 years	4.4-12.3	4.3-11.0	4.4-11.0

ABSOLUTE BASOPHIL (/μL)

Age	Male	Female	Unknown
≤ 14 days	0-110	0-70	0-70
15-30 days	0-70	0-60	0-60
1-2 months	0-70	0-50	0-50
2-6 months	0-60	0-70	0-60
6-24 months	0-60	0-60	0-60
2-6 years	0-60	0-60	0-60
6-12 years	0-60	0-50	0-50
12-18 years	0-50	0-50	0-50
≥ 18 years	0-50	0-50	0-50

ABSOLUTE MONOCYTES (/μL)

Age	Male	Female	Unknown
≤ 14 days	520-1770	570-1720	570-1720
15-30 days	280-1380	420-1210	420-1210
1-2 months	280-1050	280-1210	280-1050
2-6 months	280-1070	240-1170	280-1070
6-24 months	250-1150	260-1080	260-1080
2-6 years	190-940	240-920	240-920
6-12 years	190-850	190-810	190-810
12-18 years	180-780	190-720	190-720
≥ 18 years	190-770	290-710	290-710

IGE (%)

Age	Male	Female	Unknown
≤ 3 days		0.0-1.7	
4-14 days		0.0-1.9	
15-30 days		0.0-1.3	
1-2 months		0.0-0.9	
2-6 months		0.0-0.5	
6-24 months		0.0-0.9	
2-6 years		0.0-0.8	
6-18 years		0.0-0.3	
≥ 18 years		0.0-0.6	

PLM Laboratory Reference Ranges

ABSOLUTE IGE (/μL)

Age	Male	Female	Unknown
≤ 3 days		0-280	
4-14 days		0-270	
15-30 days		0-220	
1-2 months		0-90	
2-6 months		0-60	
6-24 months		0-140	
2-6 years		0-60	
6-12 years		0-40	
12-18 years		0-30	
≥18 years		0-90	

METAMYELOCYTES (%)

Age	Male	Female	Unknown
All ages		0-0	

MYELOCYTES (%)

Age	Male	Female	Unknown
All ages		0-0	

PROMYELOCYTES (%)

Age	Male	Female	Unknown
All ages		0-0	

BLASTS (%)

Age	Male	Female	Unknown
All ages		0-0	

PLM Laboratory Reference Ranges

MISCELLANEOUS HEMATOLOGY REFERENCE RANGES

HEMOGLOBIN ID QUANTIFICATION (%)

Genotype	A	S	C	E	A2
AA	96.4-98.2				1.8-3.6
AS	55.0-65.0	35.0-45.0			1.8-4.5
AC	60.0-70.0		30.0-40.0		1.8-4.5
AE	65.0-70.0			30.0-35.0	

ESR (mm/hr)

Age	Male	Female	Unknown
All ages		1-20	

URINALYSIS REFERENCE RANGES

CHEMISTRY

Parameter	Value
Glucose	Negative
Bilirubin	Negative
Ketones	Negative
Specific Gravity	1.003-1.035
Blood	Negative
pH	4.8-7.8
Protein	Negative
Urobilinogen	<2.0 mg/dL
Nitrite	Negative
Leukocyte	Negative

MICRSCOPIC

Parameter	Value
RBCs	Negative
WBCs	Negative
Urine Casts	Negative
Urine Epithelial Cells	Negative
Bacteria	Negative
Yeast	Negative
Mucus	Negative
Amorphous	Negative
Urine Crystals	Negative

ENHANCED URINALYSIS

Parameter	Value
WBCs (/cumm)	<10

CSF REFERENCE RANGES

Age	WBC (/μL)	RBC (/μL)	Neutrophils (%)	Lymphocytes(%)	Monocytes (%)
Neonates (<30 days old)	0-30	0	0-8	5-35	50-90
Adults	0-5	0	0-6	40-80	15-45

PLM Laboratory Reference Ranges

IMMUNOLOGY/FLOW CYTOMETRY REFERENCE RANGES

Cell Surface Marker (Peripheral Blood)	Age	Normal Range (% of total lymphs unless noted)	Normal Range (cells/ μ l)
ALPS Screen (CD3+/CD4-/CD8-/TCR a/b+)		0.0 - 2.4	0 - 45
CD3-/CD16(3G8)+		0.4 - 21.2	52 - 286
CD3-/CD16(3G8)+/CD16(B73.1)+		0.0 - 19.4	32 - 240
CD3-/CD16(3G8)+/CD56+		0.0 - 15.1	0 - 219
CD3-/CD16(B73.1)+ &/or CD56+	0 - 6 days	6 - 58	100 - 1900
	7 days - 2 months	3 - 23	200 - 1400
	3 - 4 months	2 - 14	100 - 1300
	5 - 8 months	2 - 13	100 - 1000
	9 - 14 months	3 - 17	200 - 1200
	15 - 23 months	3 - 16	100 - 1400
	2 - 4 years	4 - 23	100 - 1000
	5 - 9 years	4 - 26	90 - 900
	10 - 15 years	6 - 27	70 - 1200
> 15 years	7 - 31	90 - 600	
CD3-/CD56+		0.0 - 15.7	0 - 236
CD3+	0 - 6 days	28 - 76	600 - 5000
	7 days - 2 months	60 - 85	2300 - 7000
	3 - 4 months	48 - 75	2300 - 6500
	5 - 8 months	50 - 77	2400 - 6900
	9 - 14 months	54 - 76	1600 - 6700
	15 - 23 months	39 - 73	1400 - 8000
	2 - 4 years	43 - 76	900 - 4500
	5 - 9 years	55 - 78	700 - 4200
	10 - 15 years	52 - 78	800 - 3500
	> 15 years	55 - 83	700 - 2100
CD3+/CD4+	0 - 6 days	17 - 52	400 - 3500
	7 days - 2 months	41 - 68	1700 - 5300
	3 - 4 months	33 - 58	1500 - 5000
	5 - 8 months	33 - 58	1400 - 5100
	9 - 14 months	31 - 54	1000 - 4600
	15 - 23 months	25 - 50	900 - 5500
	2 - 4 years	23 - 48	500 - 2400
	5 - 9 years	27 - 53	300 - 2000

PLM Laboratory Reference Ranges

CD3+/CD4+	10 - 15 years	25 - 48	400 - 2100
	> 15 years	28 - 57	300 - 1400
CD3+/CD8+	0 - 6 days	10 - 41	200 - 1900
	7 days - 2 months	9 - 23	400 - 1700
	3 - 4 months	11 - 25	500 - 1600
	5 - 8 months	13 - 26	600 - 2200
	9 - 14 months	12 - 28	400 - 2100
	15 - 23 months	11 - 32	400 - 2300
	2 - 4 years	14 - 33	300 - 1600
	5 - 9 years	19 - 34	300 - 1800
	10 - 15 years	9 - 35	200 - 1200
	> 15 years	10 - 39	200 - 900
	CD3+/CD132+		69.9 - 87.2
CD3+/HLA-Dr+	0 - 6 days	1 - 6	30 - 400
	7 days - 2 months	1 - 38	30 - 3400
	3 - 4 months	1 - 9	70 - 500
	5 - 8 months	1 - 7	70 - 500
	9 - 14 months	2 - 8	100 - 600
	15 - 23 months	3 - 12	100 - 700
	2 - 4 years	3 - 13	80 - 400
	5 - 9 years	3 - 14	50 - 700
	10 - 15 years	1 - 8	20 - 200
	> 15 years	2 - 12	30 - 200
CD4+/CD45RA+		12.5 - 42.2	41 - 1121
CD4+/CD45RO+		10.1 - 27.9	153 - 582
CD5+/CD19+		0.0 - 5.2	0 - 145
CD8+/CD28-		2.1 - 25.0	23 - 479
CD11b+		Granulocytes – 90.0 - 100	
CD18+		Granulocytes – 90.0 - 100	
CD19+	0 - 6 days	5 - 22	40 - 1100
	7 days - 2 months	4 - 26	600 - 1900
	3 - 4 months	14 - 39	600 - 3000
	5 - 8 months	13 - 35	700 - 2500
	9 - 14 months	15 - 39	600 - 2700
	15 - 23 months	17 - 41	600 - 3100
	2 - 4 years	14 - 44	200 - 2100
	5 - 9 years	10 - 31	200 - 1600

PLM Laboratory Reference Ranges

CD19+	10 - 15 years	8 - 24	200 - 600
	> 15 years	6 - 19	100 - 500
CD19+ (CART Peripheral Blood Panel only - gated on total lymphocytes + any blasts present)	0 - 6 days	5 - 22	
	7 days - 2 months	4 - 26	
	3 - 4 months	14 - 39	
	5 - 8 months	13 - 35	
	9 - 14 months	15 - 39	
	15 - 23 months	17 - 41	
	2 - 4 years	14 - 44	
	5 - 9 years	10 - 31	
	10 - 15 years	8 - 24	
	> 15 years	6 - 19	
CD19+/CD10+/IgD+		0.6 - 8.2 (% of CD19+ lymphs)	1 - 35
CD19+/CD20-/IgG+		0.0 - 0.8 (% of CD19+ lymphs)	0 - 3
CD19+/CD27-/IgM+		43.8 - 92.6 (% of CD19+ lymphs)	48 - 458
CD19+/CD27+/IgD-		4.6 - 33.7 (% of CD19+ lymphs)	9 - 102
CD19+/CD27+/IgD+		3.2 - 16.2 (% of CD19+ lymphs)	6 - 55
CD19+/CD27+/IgM-		3.9 - 30.7 (% of CD19+ lymphs)	6 - 85
CD19+/CD27+/IgM+		3.8 - 18.6 (% of CD19+ lymphs)	7 - 63
CD19+/CD40+		99.4 - 100 (% of CD19+ lymphs)	102 - 607
CD19+/HLA-Dr+		5.2 - 20.8	5 - 517
CD19+/IgD+/IgM+		51.3 - 98.2 (% of CD19+ lymphs)	63 - 531
CD20+		3.1 - 21.5	0 - 479
CD22+ (CART Peripheral Blood Panel only - gated on total lymphocytes + any blasts present)		7.0 - 21.6	
HLA-ABC+		99.8 - 100	1213 - 4400
T-cell Receptor g/d+		1.1 - 10.3	6 - 211
CD4+/CD8+ Ratio	0 - 6 days	1.0 - 2.6	
	7 days - 2 months	1.3 - 6.3	
	3 - 4 months	1.7 - 3.9	
	5 - 8 months	1.6 - 3.8	

PLM Laboratory Reference Ranges

CD4+/CD8+ Ratio	9 - 14 months	1.3 - 3.9	
	15 - 23 months	0.9 - 3.7	
	2 - 4 years	0.9 - 2.9	
	5 - 9 years	0.9 - 2.9	
	10 - 15 years	0.9 - 3.4	
	> 15 years	1.0 - 3.6	
Dihydrorhodamine Assay			Resting % - \leq 5 Resting MCF - \leq 20 Stimulated % - \geq 95 Stimulated MCF - \geq 165
Lymphocyte Culture - Mitogens		Background CPM - \leq 1200	PWM CPM - \leq 20,000 PWM SI - \geq 26 ConA CPM - \geq 39,000 ConA SI - \geq 47 PHA CPM - 39,000 PHA SI - \geq 65
Lymphocyte Culture - Antigens		Background CPM - \leq 1700	Tetanus CPM - \geq 8000 Tetanus SI - \geq 11 Candida CPM - 12,000 Candida SI - \geq 13

Analyte	Age	Normal Range	Units
Allergen (non-components)		<0.35	kU/L
Allergen (components)		<0.10	kU/L
Anti-Cardiolipin - IgG		0 - 9.9	GPL U/ml
Anti-Cardiolipin - IgM		0 - 9.9	MPL U/ml
Anti- β 2 Glycoprotein II - IgG		0 - 6.9	U/ml
Anti- β 2 Glycoprotein II - IgM		0 - 6.9	U/ml
Anti-Diphtheria Antibodies		> 0.1	IU/ml
Anti-dsDNA		0 - 9.9	IU/ml
Anti-Endomysial Antibodies - IgA		Negative	
Anti-F-Actin		0 - 20	Units
Anti-Gliadin (Deamidated - DGP) - IgA		0 - 6.9	U/ml
Anti-Gliadin (Deamidated - DGP) - IgG		0 - 6.9	U/ml
Anti-Liver/Kidney Microsome 1 (LKM-1)		0 - 20	Units

PLM Laboratory Reference Ranges

Anti-Neutrophil Cytoplasmic Antibodies (ANCA)		Negative	
Anti-Nuclear Antibodies (ANA)		Negative	
Anti-RNP		0 - 4.9	U/ml
Anti-Sm		0 - 6.9	U/ml
Anti-Smooth Muscle Antibodies (ASMA)		Negative	
Anti-SS-A (Ro)		0 - 6.9	U/ml
Anti-SS-B (La)		0 - 6.9	U/ml
Anti-Tetanus Antibodies		> 0.15	IU/ml
Anti-Tissue Transglutaminase (tTG) - IgA		0 - 6.9	U/ml
Anti-Tissue Transglutaminase (tTG) - IgG		0 - 6.9	U/ml
Calprotectin - Fecal		< 15.6 - 50	µg/g
Complement C ₃	< 2 days	60 - 158	mg/dl
	2 - 7 days	67 - 161	
	8 days - 5 months	73 - 165	
	6 - 24 months	78 - 169	
	2 - 5 years	83 - 174	
	6 - 9 years	87 - 181	
	10 - 14 years	90 - 187	
	> 14 years	86 - 233	
Complement C ₄		16 - 45	mg/dl
IgA	< 1 month	0 - 5	mg/dl
	1 - 6 months	20 - 72	
	7 - 9 months	27 - 73	
	10 - 23 months	27 - 169	
	2 years	35 - 222	
	3 years	40 - 251	
	4 - 6 years	48 - 336	
	7 - 9 years	70 - 393	
	10 - 12 years	70 - 456	
	13 - 14 years	70 - 498	
	> 14 years	70 - 486	
IgE	0 - 11 months	0 - 15	IU/ml
	1 - 5 years	0 - 60	
	6 - 9 years	0 - 90	
	10 - 15 years	0 - 200	
	> 15 years	0 - 100	
IgG	< 1 month	598 - 1672	mg/dl

PLM Laboratory Reference Ranges

	1 - 6 months	218 - 636	mg/dl
	7 - 9 months	292 - 816	
	10 - 23 months	383 - 1070	
	2 years	423 - 1184	
	3 years	477 - 1334	
	4 - 6 years	539 - 1597	
	7 - 9 years	583 - 1783	
	10 - 12 years	511 - 1657	
	13 - 14 years	562 - 1607	
	> 14 years	635 - 1775	
IgG - CSF		0.5 - 6.0	mg/dl
IgG ₁	< 1 month	240 - 1060	mg/dl
	1 - 5 months	180 - 700	
	6 - 11 months	200 - 770	
	1 year	250 - 850	
	2 years	320 - 900	
	3 years	350 - 940	
	4 - 5 years	370 - 1000	
	6 - 8 years	400 - 1080	
	9 - 11 years	400 - 1150	
	12 - 17 years	370 - 1280	
	> 17 years	490 - 1140	
IgG ₂	< 1 month	87 - 410	mg/dl
	1 - 5 months	34 - 210	
	6 - 11 months	34 - 230	
	1 year	38 - 260	
	2 years	52 - 280	
	3 years	63 - 300	
	4 - 5 years	72 - 340	
	6 - 8 years	85 - 410	
	9 - 11 years	98 - 480	
	12 - 17 years	106 - 610	
	> 17 years	150 - 640	
IgG ₃	< 1 month	14 - 55	mg/dl
	1 - 5 months	14 - 80	
	6 - 11 months	15 - 97	
	1 year	15 - 113	
	2 years	14 - 120	
	3 years	13 - 126	

PLM Laboratory Reference Ranges

IgG ₃	4 - 5 years	13 - 133	mg/dl
	6 - 8 years	13 - 142	
	9 - 11 years	15 - 149	
	12 - 17 years	18 - 163	
	> 17 years	20 - 110	
IgG ₄	< 1 month	4 - 55	mg/dl
	1 - 5 months	1 - 36	
	6 - 11 months	1 - 43	
	1 year	1 - 79	
	2 years	1 - 106	
	3 years	1 - 127	
	4 - 5 years	1 - 158	
	6 - 8 years	1 - 189	
	9 - 11 years	3 - 210	
	12 - 17 years	4 - 230	
	> 17 years	8 - 140	
IgM	< 1 month	6 - 15	mg/dl
	1 - 6 months	11 - 60	
	7 - 9 months	37 - 124	
	10 - 23 months	43 - 113	
	2 years	49 - 179	
	3 years	51 - 194	
	4 - 6 years	50 - 194	
	7 - 9 years	50 - 198	
	10 - 12 years	64 - 208	
	13 - 14 years	70 - 212	
	> 14 years	71 - 237	
Lyme Antibodies - IgG/IgM (Screening ELISA)		</= 0.90	Index Value
Lyme Antibodies - IgG or IgM (Confirmatory ELISA)		</= 0.90	Index Value
Proinflammatory Cytokine Panel	IFN gamma	< 6.5	pg/ml
	IL-1 beta	< 2.5	pg/ml
	IL-2	< 6.5	pg/ml
	IL-4	< 1.5	pg/ml
	IL-6	< 3.5	pg/ml
	IL-8	< 10.0	pg/ml
	IL-10	< 2.0	pg/ml
	IL-12 p70	< 2.5	pg/ml
	IL-13	< 2.5	pg/ml
TNF alpha	< 3.5	pg/ml	
Rheumatoid Factor (RF)		Negative	
RPR		Non-reactive	

METABOLIC REFERENCE RANGES

PLASMA ACYLCARNITINE PROFILE

ACETYL C2	4.21 - 20.60 µmol/L
PROPENOYL C3:1	0 - 0.02 µmol/L
PROPIONYL C3	0 - 1.60 µmol/L
BUTYRYL/ISOB	0 - 1.00 µmol/L
TIGL/MECROT C5:1	0 - 0.20 µmol/L
3-OH-BUT C4-OH	0 - 0.40 µmol/L
ISOVALERYL C5	0 - 0.70 µmol/L
HEXANOYL C6	0.01 - 0.22 µmol/L
3-OH-ISOVAL C5-OH	0 - 0.11 µmol/L
OCTENOYL C8:1	0 - 0.70 µmol/L
OCTANOYL C8	0 - 0.50 µmol/L
MALONYL C3 -DC	0 - 0.13 µmol/L
DECADIEN C10:2	0 - 0.200 µmol/L
CIS-4-DEC C10:1	0.01 - 0.45 µmol/L
DECANOYL C10	0 - 0.90 µmol/L
MEMAL/SUCC C4-DC	0 - 0.20 µmol/L
GLUTARYL C5-DC	0 - 0.09 µmol/L
DODECADIE C12:2	0 - 0.20 µmol/L
DODECENYL C12:1	0 - 0.60 µmol/L
DODECANOYL C12	0 - 0.60 µmol/L
ADIP/MEGLU C6-DC	0 - 0.10 µmol/L
TETRADEC C14:2	0 - 0.15 µmol/L
TETRADECEN C14:1	0 - 0.30 µmol/L
TETRADECAN C14:0	0 - 0.30 µmol/L
SUBERYL C8-DC	0 - 0.08 µmol/L
3-OH-C12:1	0 - 0.05 µmol/L
3-OH-C12:0	0 - 0.08 µmol/L
3-OH-C14:1	0 - 0.05 µmol/L
3-OH-C14:1	0 - 0.04 µmol/L
HEXADECADIE 16:2	0 - 0.2 µmol/L
HEXADECENYOY 16:1	0 - 0.2 µmol/L
PALMITOYL C16	0 - 1.0 µmol/L
3-OH-C16	0 - 0.06 µmol/L
LINOLEOYL C18:2	0 - 0.30 µmol/L
OLEOYL C18:1	0 - 0.50 µmol/L
OCTADECANOY 18:0	0 - 0.11 µmol/L
3OH-LIN C18:20H	0 - 0.05 µmol/L
3OH-OLEOYL C18:1	0 - 0.03 µmol/L
C16-DC	0 - 0.03 µmol/L
C18:1-DC	0 - 0.03 µmol/L

FREE AND TOTAL CARNITINE ANALYSIS

	PLASMA	URINE
TOTAL CARNITINE	25 - 69 nmol/mL	50 - 200 nmol/mg creatinine
FREE CARNITINE	17 - 59 nmol/mL	34 - 114 nmol/mg creatinine
ACYLCARNITINE	4 - 14 nmol/mL	11 - 91 nmol/mg creatinine
RATIO (FREE/TOTAL)	0.68 - 0.86	

PLM Laboratory Reference Ranges

DISACCHARIDASE ENZYME ANALYSIS

ENZYME	NORMAL	DEFICIENT
Lactase	14 – 33 nmol/min/mg protein	< 14 nmol/min/mg protein
Sucrase	25 – 66 nmol/min/mg protein	< 25 nmol/min/mg protein
Maltase	135 – 205 nmol/min/mg protein	< 110 nmol/min/mg protein
Palatinase	8.5 – 22 nmol/min/mg protein	< 8.5 nmol/min/mg protein

GALACTOSE -1- PHOSPHATE ANALYSIS

Normal < 1.5mg% (mg/dL)
 Classic Galactosemics on lactose free diet: 1.5mg% – 6 mg%

URINE GALACTITOL ANALYSIS

Age Range	Normal	Classic Galactosemia
< 1 year	< 2 – 78	183 – 800
1 – 6 year	< 2 – 36	194 – 620
> 6 year	< 2 – 19	98 – 282

GALACTOSEMIA QUANTITATION (GALACTOSE-1-PHOSPHATE URIDYLTRANSFERASE ENZYME ACTIVITY)

Normal: 19.4 – 40.1 nmol/hr/g hemoglobin
 Duarte Heterozygote: 9.6 – 19.6 nmol/hr/g hemoglobin
 Duarte/Classic Galactosemia Heterozygote: 4.1 – 8.0 nmol/hr/g hemoglobin
 Classic Galactosemia: 0.0 – 2.3 nmol/hr/g hemoglobin

GALACTOKINASE ENZYME ACTIVITY

Normal: 0.85 – 2.09 µmol/hr/g hemoglobin

UDP-GALACTOSE-4-EPIMERASE ENZYME ACTIVITY

Normal: > 3.0 mmol/hr/g hemoglobin
 Epimerase Deficient: < 0.5 mmol/hr/g hemoglobin

METHYLMALONIC ACID ANALYSIS

Normal: <50 - 370 nmol/L
 Methylmalonic Aciduria Patients: > 100,000 nmol/L

URINE OROTIC ACID ANALYSIS

Age Range	Normal
< 14 days	2.27 – 4.13 mmol/mol creatinine
15 days – 12 months	1.15 – 3.09 mmol/mol creatinine
13 months – 10 years	1.12 – 2.52 mmol/mol creatinine
> 10 year	0.5 – 0.98 mmol/mol creatinine

PYRUVATE/LACTATE ANALYSIS

Sample	Lactate	Pyruvate	L/P Ratio
Blood	0.8 – 2.0mM	0.5 – 0.14mM	10 – 20
CSF	0.7 – 2.0mM	0.5 – 1.17mM	10 – 20

KETONE BODY PANEL

Acetoacetate (AcAc): 0.0072 – 0.2409 mM
 Beta-hydroxybutyrate (BHB): 0.0078 – 0.4101 mM
 BHB/AcAc: 0.4757 – 2.5654 mM
 Alpha-hydroxybutyrate (AHB): 0.0106 – 0.1031 mM
 Gamma-hydroxybutyrate (GHB): <0.0025 mM
 Beta-hydroxyisobutyrate (BHIB): <0.0050 – 0.0439 mM

PLM Laboratory Reference Ranges

OLIGOSACCAHRIDES AND GLYCOAMINO ACIDS

	<2m		2m - 1 yr		1-3 yr		> 4 yr	
UA-HexNac-1S, #1	0.0	- 8.0	0.0	- 8.0	0.0	- 8.0	0.0	- 8.0
UA-HexNac-1S, #2	0.0	- 8.0	0.0	- 8.0	0.0	- 8.0	0.0	- 8.0
UA-HexN-UA-2S	0.0	- 9.7	0.0	- 13.3	0.0	- 8.2	0.0	- 8.0
HexN-UA-1S	0.0	- 49.7	0.0	- 49.7	0.0	- 41.0	0.0	- 24.6
HexN-UA-HexNac-UA-2S	0.0	- 16.3	0.0	- 19.2	0.0	- 18.8	0.0	- 10.5
HexNac-UA-HexNac-1S	0.0	- 8.0	0.0	- 8.0	0.0	- 8.0	0.0	- 8.0
(HexNac-UA)2	0.0	- 28.5	0.0	- 18.0	0.0	- 11.4	0.0	- 5.0
HexN-UA-HexNac-1S, #2	0.0	- 8.0	0.0	- 8.0	0.0	- 8.0	0.0	- 8.0
(HexN-UA)2-HexNac-2S	0.0	- 8.0	0.0	- 8.0	0.0	- 8.0	0.0	- 8.0
HexNac-UA-1S, #2	0.0	- 52.8	0.0	- 42.9	0.0	- 34.2	0.0	- 10.0
HexNac-UA-HexNac-2S	32.8	- 483.5	43.6	- 251.5	19.8	- 159.6	0.0	- 87.8
UA-HexNac	1470.0	- 9883.4	714.7	- 4600.7	355.1	- 2900.2	312.5	- 2144.3
HexNac-UA-HexNac	147.6	- 981.2	66.0	- 430.7	35.2	- 238.1	25.0	- 186.9
Hex3-HexNac2	0.0	- 78.5	0.0	- 32.7	0.0	- 25.7	0.0	- 17.5
Hex5-HexNac3	0.0	- 79.6	0.0	- 20.9	0.0	- 18.9	0.0	- 15.0
Hex2-HexNac3	0.0	- 12.0	0.0	- 7.3	0.0	- 5.3	0.0	- 4.0
Hex3-HexNac4	0.0	- 4.0	0.0	- 4.0	0.0	- 4.0	0.0	- 4.0
Hex-HexNac	4674.7	- 24048.9	1612.4	- 18383.1	1474.9	- 10425.1	1124.5	- 5870.9
Hex3-HexNac	99.2	- 462.1	94.4	- 449.7	53.4	- 325.6	35.0	- 204.6
Hex4-HexNac	0.0	- 103.1	0.0	- 69.9	0.0	- 62.4	0.0	- 30.9
Fuc-HexNac	244.5	- 1184.7	206.5	- 1217.4	124.9	- 768.5	55.9	- 467.4
Fuc-GlcNac-Asn	0.0	- 1463.5	0.0	- 1343.9	0.0	- 913.4	0.0	- 403.0
Neu5Ac-Hex3-HexNac2	0.0	- 34.3	0.0	- 30.1	0.0	- 22.6	0.0	- 20.2
Neu5Ac2-Hex5-HexNac3	0.0	- 217.6	0.0	- 60.1	0.0	- 48.6	0.0	- 38.5
Hex4	0.0	- 19058.9	0.0	- 15977.0	0.0	- 9748.6	0.0	- 3132.1
Hex3	0.0	- 58454.4	0.0	- 59415.3	0.0	- 15621.0	0.0	- 4936.0
GlcNac-Asn	0.0	- 10156.1	0.0	- 11192.9	0.0	- 11624.3	0.0	- 3649.5
GalNac-Thr	0.0	- 2882.4	0.0	- 1903.3	0.0	- 771.6	0.0	- 297.1
GlcNac-6S	0.0	- 6430.5	0.0	- 10318.7	0.0	- 3850.6	0.0	- 1773.0
GalNac-6S	0.0	- 12025.3	0.0	- 4825.5	0.0	- 3666.9	0.0	- 2115.9
GalNac-4S	0.0	- 64997.7	0.0	- 18435.7	0.0	- 15188.3	0.0	- 9952.0
GalNac-6S/GalNac-4S	0.22	- 0.64	0.18	- 0.43	0.16	- 0.34	0.13	- 0.29
Hex4/Hex3	0.00	- 1.71	0.00	- 2.41	0.00	- 3.19	0.00	- 2.90

PLM Laboratory Reference Ranges

AMINO ACID ANALYSIS

Units for Plasma and CSF Samples: $\mu\text{mol/L}$

for Urine samples: $\mu\text{mol/g creatinine}$

NRE = No range established

Amino Acid	Plasma 1d-3wk	Plasma 4wk-adult	CSF	Urine 1d - 6d	Urine 7d - 2m	Urine 2m - 1y	Urine 1y - 3 y	Urine 4y - Adult
Phosphoserine	10 - 40	8 - 35	5 - 25	200 - 970	300 - 1400	200 - 700	200 - 600	175 - 450
Taurine	49 - 115	55 - 204	NRE	511 - 4010	194 - 2394	116 - 2639	168 - 2446	66 - 1454
Phosphoethanolamine	5-50	5 - 20	4 - 16	200 - 550	260 - 1200	150 - 375	100 - 350	0 - 150
Aspartic	8-38	0 - 31	0 - 4	75 - 500	150 - 400	150 - 450	50 - 275	0 - 175
Hydroxyproline	0-82	0 - 68	0 - 10	148 - 1287	497 - 1479	107 - 1280	0 - 594	0 - 193
Threonine	120-285	86 - 321	17 - 80	149 - 355	175 - 915	130 - 580	79 - 451	44 - 322
Serine	46-253	50 - 215	13 - 80	376 - 1323	737 - 1565	590 - 1751	345 - 1200	126 - 585
Asparagine	30-83	19 - 106	0 - 22	21 - 173	27 - 368	84 - 325	27 - 443	23 - 286
Glutamic Acid	55-166	24 - 163	0 - 12	0 - 132	0 - 233	0 - 102	0 - 173	0 - 83
Glutamine	317 - 1051	345 - 1006	228 - 1008	264 - 727	899 - 1813	597 - 1955	170 - 1666	188 - 836
Sarcosine	NRE	NRE	NRE	0 - 286	0 - 371	0 - 221	0 - 260	0 - 260
α -Amino Adipic Acid	NRE	NRE	NRE	0 - 135	0 - 74	0 - 135	0 - 225	0 - 134
Proline	67-270	83 - 346	NRE	0 - 880	0 - 551	0 - 445	0 - 72	NRE
Glycine	192-491	103 - 424	1.2 - 15.7	1026-15250	3539 - 12622	974 - 8046	354 - 6313	388 - 2261
Alanine	120-449	88 - 440	16 - 57	165 - 1120	379 - 1621	258 - 1422	189 - 1370	73 - 604
Citrulline	2 - 38	4 - 46	0 - 3	0 - 54	0 - 141	0 - 110	0 - 84	0 - 52
α -Aminobutyric Acid	0 - 20	0 - 43	0 - 5	0 - 30	0 - 81	0 - 96	0 - 48	0 - 34
Valine	71-236	93 - 321	0 - 34	27 - 235	11 - 326	6 - 246	12 - 227	5 - 130
Cystine	3 - 59	2 - 47	NRE	109 - 530	46 - 654	29 - 308	21 - 127	5 - 130
Methionine	18 - 48	8 - 49	0 - 24	34 - 486	697 - 296	76 - 546	20 - 179	18 - 130
Cystathionine	0 - 12	0 - 12	NRE	NRE	NRE	NRE	NRE	NRE
Isoleucine	11 - 87	17 - 106	2 - 15	80 - 325	35 - 362	59 - 245	15 - 188	17 - 74
Alloisoleucine	0	0	0	0	0	0	0	0
Leucine	29 - 152	42 - 188	20 - 200	20 - 200	20 - 240	30 - 305	20 - 225	10 - 110
Tyrosine	32 - 109	22 - 102	4 - 26	32 - 221	113 - 408	135 - 557	71 - 602	73 - 416
Phenylalanine	38 - 85	23 - 95	5 - 25	0 - 61	37 - 363	110 - 309	47 - 259	17 - 100
β -Alanine	NRE	NRE	NRE	0 - 135	0 - 38	0 - 112	0 - 117	0 - 79
β -Amino Isobutyric Acid	NRE	NRE	NRE	0 - 920	0 - 1211	0 - 916	38 - 628	0 - 409
Homocystine	0	0	NRE	0 - 12	0 - 13	0 - 21	0 - 28	0 - 20
GABA	NRE	NRE	NRE	0 - 68	0 - 81	0 - 83	0 - 56	0 - 19
Ethanolamine	0-50	0-50	NRE	NRE	NRE	NRE	NRE	NRE
Hydroxylysine Pk 1	NRE	NRE	NRE	NRE	NRE	NRE	NRE	NRE
Hydroxylysine Pk 2	NRE	NRE	NRE	NRE	NRE	NRE	NRE	NRE
Ornithine	26-164	13 - 151	4 - 19	25 - 415	57 - 317	30 - 186	16 - 138	9 - 116
Lysine	67-230	71 - 217	12 - 39	189 - 923	191 - 1198	161 - 721	138 - 599	73 - 270
1-Methylhistidine	NRE	NRE	NRE	0 - 1889	0 - 1889	0 - 1889	0 - 1889	0 - 1889
Histidine	37-111	38 - 132	12 - 39	18 - 952	757 - 2744	742 - 2794	491 - 2345	303 - 1820
3-Methylhistidine	NRE	NRE	NRE	81 - 384	75 - 430	142 - 377	134 - 647	93 - 323
Anserine	NRE	NRE	NRE	NRE	NRE	NRE	NRE	NRE
Carnosine	NRE	NRE	NRE	60 - 350	75 - 650	200 - 800	50 - 400	10 - 200
Arginine	23-120	15 - 120	10 - 47	16 - 104	5 - 155	28 - 126	13 - 95	6 - 37
Tryptophan	NRE	NRE	NRE	NRE	NRE	NRE	NRE	NRE