

**LABORATORY SERVICES**  
***TECHNICAL BULLETIN***



**New Chemistry System**

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The laboratory will be replacing the current chemistry analyzer (after 6 years) with the Johnson & Johnson Vitros 5600, a system which integrates dry chemistry, wet chemistry, and other test systems with a menu capability of more than 120 tests. This instrument is used by the majority of the Children's Hospitals in CHCA. With different instrumentation and methodologies there are some assays that will have variations in reference ranges and they will be adjusted accordingly. We have reached out to other Children's Hospitals within our CHCA network to establish reference ranges specific to pediatrics and specific to our instrumentation. Most of the reference ranges will remain near the current ones, with the exception of LIPASE and LDH. With this new instrumentation we are also incorporating a true Neonatal Bilirubin as opposed to calculated methods. Explanations for the differences in LDH, Lipase and Neonatal Bilirubin are shown below.

**NEW REFERENCE RANGES (Highlighted)**

**LACTATE DEHYRDOGENASE(LDH):** The LDH test utilizes the pyruvate to lactate reaction sequence, the sequence that naturally occurs. This scheme allows the reaction to run faster, has better precision, and higher rates (sensitivity). It is the recommended reaction scheme of the International Federation of Clinical Chemistry. Values of LDH will be approximately 3X higher.

**OLD LACTATE DEHYRDOGENASE (LDH)**

1-30d	Male	178-629	Female	187-600 U/L
1-3 mos		158-373		152-353
4-6 mos		135-376		158-353
7-12 mo		129-367		152-327
1-3 yr		164-286		164-286
4-6 yr		155-280		155-280
7-9 yr		141-237		141-237
10-13 yr		141-231		129-222
16-150 yr		117-217		117-213

**NEW LACTATE DEHYRDOGENASE (LDH)**

<b>1 – 30 Days</b>	<b>Male</b>	<b>550 – 2100</b>	<b>Female</b>	<b>580 – 200 U/L</b>
<b>1 – 3 Months</b>		<b>480 – 1220</b>		<b>460 – 1150</b>
<b>4 – 6</b>		<b>400 – 1230</b>		<b>480 – 1150</b>

<b>7 – 12</b>	<b>380 – 1200</b>	<b>460 – 1060</b>
<b>1 – 3 Years</b>	<b>500 – 920</b>	<b>500 – 920</b>
<b>4 – 6</b>	<b>470 – 900</b>	<b>470 – 900</b>
<b>7 – 9</b>	<b>420 – 750</b>	<b>420 – 750</b>
<b>10 – 11</b>	<b>432 – 700</b>	<b>380 – 700</b>
<b>12 – 13</b>	<b>470 – 750</b>	<b>380 – 640</b>
<b>14 – 15</b>	<b>360 – 730</b>	<b>390 – 580</b>
<b>16 – 19</b>	<b>340 – 670</b>	<b>340 – 670</b>

**LIPASE:** Small elevations of lipase not caused by acute pancreatitis may be caused by pancreatic sensitivity to inflammation in other organs. To increase the diagnostic efficiency, most studies suggest utilizing 2-5x the upper limit of normal as an indicator of acute pancreatitis. Lipase methods which utilize co-lipase increase the amount of detectable pancreatic lipase activity.

### **ADVANTAGES OF VITROS METHOD FOR LIPASE**

#### 1. Addition of COLIPASE

Full catalytic activity of lipase requires calcium, low NaCl concentration, bile salts, colipase and pH 8.5-9.4. Presence of bile salts or high protein concentration in a serum sample inhibits the lipase activity, but colipase prevents this inhibition from occurring. Lipase methods which utilize excess colipase increase the amount of detectable pancreatic lipase activity. Other forms of lipase are also inhibited by bile salts but colipase does not overcome this inhibition thus rendering methods with colipase very specific for pancreatic lipase. Older lipase methods did not contain colipase thus rendering it a less than suitable method to diagnose pancreatitis.

The addition of colipase is important for measurement of complete lipase activity because colipase is often suboptimal or absent in patients with pancreatitis, thus a lower lipase value as seen in those methodologies without colipase added.

2. No interferences from HEMOLYSIS, BILIRUBIN, LIPEMIA or CARBOXYLESTERASE
3. Quicker Assay Time

### **OLD LIPASE**

0 – 150 Years                      8 – 78 U/L

### **NEW LIPASE**

	<b>Male</b>	<b>10 – 85 U/L</b>	<b>Female</b>	<b>10 – 85 U/L</b>
<b>0 – 90 Days</b>				
<b>3 – 12 Months</b>		<b>13 – 95</b>		<b>9 – 128</b>
<b>1 – &lt;2 Years</b>		<b>15 – 135</b>		<b>15 – 150</b>
<b>2 – &lt;7</b>		<b>15 – 175</b>		<b>10 – 150</b>
<b>7 – &lt;11</b>		<b>10 – 175</b>		<b>13 – 150</b>
<b>11 – &lt;15</b>		<b>10 – 195</b>		<b>10 – 180</b>
<b>15 – 18</b>		<b>10 – 195</b>		<b>10 – 220</b>

**TOTAL, DIRECT, AND NEONATAL BILIRUBIN:** Our current Abbott system uses diazo chemistry to directly measure both total bilirubin and the direct fraction (approximately equivalent to Bc), but cannot directly measure unconjugated bilirubin (Bu). Indirect bilirubin is calculated by total bilirubin – direct bilirubin. Variation and error in determination of either of the measured fractions may contribute to errors in the estimated indirect bilirubin.

The introduction of the Vitros dry slide technology, using differential spectrophotometry to measure conjugated and unconjugated bilirubin separately, led to the observation that the sum of these entities did not equal total bilirubin. Approximately 70-80% of conjugated bilirubin and delta bilirubin and a small percentage of unconjugated bilirubin are measured in the direct bilirubin assay.

The Vitros BuBc test is used to measure bilirubin in neonatal specimens and is referred to as neonatal bilirubin(NBil). The results for BuBc and neonatal bilirubin(NBil) provide clinicians with a complete clinical picture. Bu (unconjugated) and Bc (conjugated) will be measured in all neonates (0-30 days) and total bilirubin will be calculated from these direct measures. Total bilirubin should not be used for neonatal samples. NBil should be continued past 30 days of age to monitor infants previously tested with NBil. Biases up to 10% have been observed with neonatal samples when using TBIL.

**OLD NEONATAL BILIRUBIN**

Did not previously have a Neonatal Bilirubin.

**NEW NEONATAL BILIRUBIN (Bu +Bc=NBil)**

**0 – 1 month                    1.0 – 10.5 mg/dL**  
**High Critical                15 mg/dL or more**

**Total and Direct Bilirubin normal range for post neonatal patients remains the same.**

**OLD AMMONIA**

0 – 1 Months		21-95 umol/L
1 – 12 Months		18-74
1 –14 Years		17-68
14 –150	Male	21-71
	Female	19-63

**NEW AMMONIA**

**0 – 1 Month                    <50 umol/L**  
**1 Month – 18 Years       <35**

**OLD CALCIUM**

0 – 10 Days	7.6 – 10.4 mg/dL
10 Days – 1 Year	9.0 – 11.0
1 – 4 Years	8.7 – 9.8
4 – 10	8.8 – 10.1
10 – 12	8.9 – 10.1
12 – 14	8.8 – 10.6

14 – 16		9.2 – 10.7
16 – 19		8.9 – 10.7
19 – 60		8.4 – 10.2
60 –150	M	8.8 – 10.0
	F	8.4 – 10.2

Old Critical High > or = 11.5 mg/dL

**NEW CALCIUM**

0-7 days	7.3-12 mg/dL
7days-1 month	6.3-11.9
1 mo-24mo	8.8-11.2
2yr-16yr	8.6-11.0
>16yr	8.8-10.5

New Critical High > or = 12.3 mg/dL

**OLD CHOLESTEROL**

0 – 4 Years	Male	114 – 203	Female	112- 200 mg/dL
4 – 7		108 – 187		108-187
7 – 10		112-247		112 –247
10 – 12		125 – 230		127-244
12 –14		127 – 230		125-213
14 – 16		106 – 224		130-213
16 – 20		110 – 220		106-217
20 – 25		124 – 218		122-216
25 – 150		133 – 244		128-222

**NEW (Cholesterol)**

Newborn -3day	45-98 mg/dL
3day-1yr	69-174
1yr-4yr	45-182
4yr-7yr	109-189
7yr-10yr	112-199
10yr-12yr	126-199
12yr-14yr	127-199
14yr-16yr	107-199
>16yr	111-199

**OLD CREATINE KINASE**

0 – 5 Years	Male	41-277	Female	34-204 U/L
5-10 yrs.		10-38		44-189
10-20 yrs.		38-255		28-170
20-150 yrs.		20-269		22-269

**NEW CREATINE KINASE**

0 – 3 Months	Male	28 – 300 U/L	Female	42 – 305 U/L
3 – 12		24 – 170		26 – 240
13 – 24		27 – 160		24 – 175

<b>2 – 10 Years</b>	<b>30 – 150</b>	<b>24 – 175</b>
<b>11 – 14</b>	<b>30 – 150</b>	<b>30 – 170</b>
<b>15 – 18</b>	<b>33 – 145</b>	<b>27 – 140</b>

### **OLD FERRITIN**

Newborn infants:	25-200 ng/ml
1 month:	200-600
2 to 5 months:	50-200
6 months to 15 years:	7-140
Adult Male:	20-250
Adult Female:	10-120

### **NEW FERRITIN**

<b>0 – 6 Weeks</b>		<b>0 – 400 ng/mL</b>
<b>7 Weeks – 365 Days</b>		<b>10 – 95</b>
<b>1 – 9 Years</b>		<b>10 – 60</b>
<b>10 – 18</b>	<b>M</b>	<b>10 – 300</b>
	<b>F</b>	<b>10 – 70</b>

### **OLD FOLLICLE-STIMULATING HOROMONE (FSH)**

0 - 2 Years	Male	0.2 - 1.8	Female	0.2 - 6.6 mIU/mL
2 - 5		0.2 - 1.4		0.2 - 3.8
6 - 10		0.2 - 1.3		0.2 - 2.7
11 - 20		0.2 - 8.0		0.2 - 8.0
20 -150		1.0 - 7.0		

Follicular	1.0 - 9.0 mIU/mL
Ovulatory Peak	6.0 - 26.0
Luteal	1.0 - 9.0
Postmenopausal	30.0 - 118.0

### **NEW FOLLICLE-STIMULATING HOROMONE (FSH)**

<b>1 – 9 Years</b>	<b>Male</b>	<b>0 – 5.0 U/L</b>	<b>1 – 2 Years</b>	<b>Female</b>	<b>0 – 8.0 mIU/mL</b>
<b>10 – 11</b>		<b>0 – 6.0</b>	<b>3 – 8</b>		<b>0 – 5.0</b>
<b>13 – 18</b>		<b>0 – 10.0</b>	<b>9 – 11</b>		<b>0 – 10.0</b>
			<b>12 – 18</b>		<b>0 – 15.0</b>

### **OLD MAGNESIUM**

Serum or Plasma	
0 – 7 Days	1.3 – 2.2 mEq/L
7 – 30	1.3 – 2.0
1 – 12 Months	1.3 – 2.2
2 – 6 Years	1.2 – 2.0
6 – 10	1.3 – 1.9
10 – 14	1.3 – 1.8
14 – 18	1.2 – 1.9
18 – 150	1.3 – 2.1

Serum/Plasma  
 Low Critical 1.0 mEq/L or less  
 High Critical 2.5 mEq/L or more

Urine  
 0 – 150 Years 6.0 – 10.0 mEq/Day

**NEW MAGNESIUM**

**\*\*Please note change in units from mEq/L to mg/dL\*\***

Serum or Plasma

**0 – 7 Days 1.2 – 2.6 mg/dL**  
**7 – 30 1.6 – 2.4**  
**1 – 12 Months 1.6 – 2.6**  
**1-2 Year 1.6-- 2.6**  
**2 – 6 Years 1.5 – 2.4**  
**6 – 10 1.6 – 2.3**  
**10 – 14 1.6 – 2.2**  
**14 + 1.5 – 2.3**

Serum/Plasma

**Low Critical 1.0 mg/dL or less**  
**High Critical 3.5 mg/dL or more**

Urine

**0 – 150 Years 6.0 – 10.0 mg/Day**

**OLD TRIGLYCERIDES**

0 – 1 Years	30 – 100 mg/dL	
1 – 4	27 – 125	
4 – 7	32 – 116	
7 – 10	28 – 129	
10 – 12	Male 24 – 137	Female 39 – 140
12 – 14	24 – 145	37 – 130
14 – 16	34 – 165	38 – 135
16 – 20	34 – 140	37 – 140
20 – 30	44 – 249	36 – 144
30 – 40	50 – 231	39 – 176
40 – 50	55 – 327	45 – 214
50 – 150	58 – 286	52 – 262

**NEW TRIGLYCERIDES**

<b>0 – 7 Days</b>	<b>Male 21 – 182</b>	<b>Female 28 – 166 mg/dL</b>
<b>8 – 30</b>	<b>30 – 184</b>	<b>30 – 165</b>
<b>31 – 90</b>	<b>40 – 175</b>	<b>35 – 282</b>
<b>91 – 180</b>	<b>45 – 291</b>	<b>50 – 355</b>
<b>181 – 365</b>	<b>45 – 501</b>	<b>36 – 431</b>
<b>1 – 3 Years</b>	<b>27 – 125</b>	<b>27 – 125</b>
<b>4 – 6</b>	<b>32 – 116</b>	<b>32 – 116</b>

<b>7 – 9</b>	<b>28 – 129</b>	<b>28 – 129</b>
<b>10 – 11</b>	<b>24 – 137</b>	<b>39 – 140</b>
<b>12 – 13</b>	<b>24 – 145</b>	<b>37 – 130</b>
<b>14 – 15</b>	<b>34 – 165</b>	<b>38 – 135</b>
<b>16 – 19</b>	<b>34 – 140</b>	<b>37 – 140</b>

**OLD URINE PROTEIN**

Random Urine Collections

0 – 150 Years                      Male/Female                      1 - 14 mg/dL

Timed Urine Collections

0 – 150 Years                      Male/Female                      50 - 80 mg/24 hours

**NEW URINE PROTEIN**

**Random Urine Collections**

**0 – 150 Years                      Male/Female                      <30 mg/dL**

**Timed Urine Collections**

**0 – 150 Years                      Male/Female                      28-141 mg/24 hours**

**SOURCES**

Lucile Packard Children’s Hospital at Stanford. Palo Alto, California 94304.  
 (\*\*Magnesium Critical Values Only\*\*)

Soldin, Steven, Carlo Brugnara, and Edward Wong. *Pediatric Reference Intervals*. Sixth. Washington D.C.: AACCPress, 2007.

Texas Children’s Hospital, Department of Pathology. Houston, Texas 77030.  
 (\*\*Urine Protein Reference Ranges Only\*\*)

Arkansas Children’s Hospital, One Children’s Way, Little Rock , AR 72202,  
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Al Dupont Hospital for Children, unpublished.