Lab Dept:	**Chemistry**
Test Name:	**NEWBORN METABOLIC SCREEN, MINNESOTA**

General Information

Lab Order Codes:	PKUN
Synonyms:	Newborn Screen for Hyopothyroidism, Phenylketonuria (PKU), Galactosemia, Hemoglobinopathy, and Congential Adrenal Hyperplasia (CAH); Congential Adrenal Hyperplasia; Galactosemia Screen ; Hemoglobinopathy Screen; Hypothyroidism Screen; Inborn Errors of Metabolism Screen; Newborn Metabolic Screening; Phenylketonuria Screen; PKU Screen; Amino Acidemia; Fatty Acid Oxidation; Organic Acidemias; Cystic Fibrosis; PKU/Thyroid Newborn Screen; Severe Combined Immune Deficiency (SCID); X-linked Adrenoleeukodystrophy
CPT Codes:	S3620 – Newborn metabolic screening panel, including test kit, postage and the laboratory tests specified by the state for inclusion in this panel
Test Includes:	Amino Acidemia Screen including: Phenylketonuria, Maple Syrup Disease, Citrullemia, Arginosuccinic Aciduria, Homocystinuria, Arginemia, Tyrosinemia Type I; Congenital Adrenal Hyperplasia Screen; Hypothyroid Screen (TSH), Fatty Acid Oxidation Screen including: Very Long Chain Acyl-CoA Dehydrogenase Deficiency, Medium Chain Acyl-CoA Dehydrogenase Deficiency, Short Chain Acyl-CoA Dehydrogenase Deficiency, Long Chain Hydrozy Acyl-CoA Dehydrogenase Deficiency, Carnitine/Acylcarnitine Traslocase Deficiency, Carnitine Palmitoyl Transerase II Deficiency, Hydroxy Acyl-CoA Dehydrogenase 3-Ketoacyl-CoA Thiolase/Enoyl-CoA Hydratase Deficiency; Galactosemia Screen, Hemoglobinopathy Screen, Organic Acidemia Screen including: Glutaric Acidemia Type I, Propionic Acidemia, Methylmalonic Acidemia, Isovaleric Acidemia, 3-Methyl-Crotonyl-CoA Carboxylase Deficiency, 3-Hydroxy-Methyl-Glutaryl-CoA Lyase Deficiency; Cystic Fibrosis; Biotinidase; Galactose; X-linked Adrenoleukodystrophy; Lysosomal Disease Profile (Mucopolysaccharidosis type I – MPS1 and Pompe Disease); Spinal Muscular Atrophy (SMN1 gene); Congenital cytomegalovirus (cCMV)

Logistics

Test Indications:	State of Minnesota requires newborn screening for common metabolic disorders or disease states which can lead to clinical consequences such as mental retardation, hemolytic episodes, and death. See Special Instructions for more information.
Lab Testing Sections:	Chemistry - Sendouts
Referred to:	Minnesota Department of Health (MDH)

Phone Numbers:	MIN Lab: 612-813-6280 STP Lab: 651-220-6550
Test Availability:	Daily, 24 hours
Turnaround Time:	5 - 7 days, test set up Monday - Friday
Special Instructions:	**Infants >1800 grams at birth:** Newborn screening should be collected between 24-48 hours after birth. Infants <24 hours old requiring **any blood cell or blood product (ie, FFP, cryoprecipitate, platelets) transfusion** should have a newborn screening card collected prior to transfusion. A second card should be collected at the normal time when the infant is >24 hours old. The second card should indicate that the sample is post-transfusion. Depending on the results, a third card may be required 2 months post transfusion. Infants <24 hours old who are transfused, but NO card was collected prior to transfusion should have a card collected at the normal time when the infant is >24 hours old. That card should indicate post transfusion. A second collection may be required may be required 2 months post transfusion depending on the Newborn Screening Results. **Infants <1800 grams at birth:** Infants weighing less than 1800 grams should have three newborn screens collected. An initial screen should be collected between 24 and 48 hours of age and subsequent specimens should be collected at 14 and 30 days of age. If an infant requires a transfusion prior to 24 hours of age, a specimen should be collected pre-transfusion, but **the second specimen will not be collected until 14 days of age**. If an infant is discharged prior to this time when a subsequent screen would be done, the specimen should be collected at the time of discharge. In order to help keep track of specimens from infants weighing less than 1800 grams, special yellow NICU newborn screening cards have been printed. They can be ordered through the Financial Management area of the Minnesota Department of Health, just like traditional cards are ordered. See Limitations for further explanation of the impacts of blood transfusion on Newborn Screening results.

Specimen

Specimen Type:	Whole blood
Container:	Minnesota Department of Health specimen 6-spot collection card
Draw Volume:	Approximately 0.5 mL blood

Processed Volume:

6 completely filled circles on specimen card

Note: MDH provided new 6-spot cards in April of 2023. Old 5-spot cards should be discarded. Specimens inadvertently collected on 5-spot cards will not be rejected by MDH as long as specimen quantity is sufficient.

Collection:

Warm the heel. Sterilize skin and allow to thoroughly air dry. Puncture heel with sterile, disposable lancet, using a firm, quick stab making a 1mm incision, 2.5 mm long. For premies, it is safer to make the incision more shallow. Allow a large drop of blood to accumulate and wipe away with sterile gauze. Allow a second large drop of blood to accumulate. Apply the second drop to the reverse side of the filter paper until the circle is filled completely when viewed from the other side. Avoid repeated applications to filter paper to fill one circle. Allow circles to fill by natural flow. Do not touch filter paper to puncture site. Avoid squeezing tissue to obtain blood as this may dilute the specimen. Avoid touching blood collection area of filter paper prior to, during, and following sampling. Completely fill all circles on the filter paper collection form. Allow blood spots to air dry for a minimum of three (3) hours. **Do Not** expose to heat or moisture

Note: For **all patients** a heel stick is the preferred standard method of collection yielding the highest quality results. Poor quality specimens place an unnecessary burden on the screening facility, cause unnecessary trauma to the infant and anxiety to the infant's parents, potentially delay the detection and treatment of the affected infant, and may contribute to a missed or late diagnosed case. **Premies and sick newborns:** If appropriate, a heel stick can also be used for this patient population. However, if indicated, blood can be drawn from an umbilical catheter line. Make sure to draw off 2-2.5 mL's before collecting the newborn screening specimen. Collect the blood in a syringe and apply it to the circles immediately to avoid blood clots that would make the specimen unsatisfactory. Each circle holds 0.1 mL's of blood.

The filter paper cannot have multiple applications of blood, each spot needs to be filled from a one time application.

See Special Instructions for information on timing of collections.

Special Processing:

Do Not dry specimen under a lamp.

Protect drying cards from contamination.

Complete all the information requested on the collection card: mother's full name, baby's name, baby's date of birth, birth-weight, hospital of birth, date/time of specimen collection, date of transfusion (if applicable).

Do Not fold filter paper or form

Patient Preparation:

See Collection

Sample Rejection: Multiple applications of blood to the filter paper; insufficient specimen quantity; specimens collected from a syringe

Interpretive

Reference Range:

Galactosemia (GALT & TGAL)	Within Normal Limits GALT >3.2 U/dL TGAL <12 mg/dL
Hemoglobinopathies	Within Normal Limits (Winthin Normal Limits = FA)
Congenital Hypothyroidism (TSH)	Within Normal Limits (Age dependent)
Amino Acidemia Profile	Within Normal Limits
Cystic Fibrosis (IRT)	Within Normal Limits <96th Percentile
Acylcarnitine Profile	Within Normal Limits
Biotinidase Deficiency (BTD)	Within Normal Limits (>55 U/dL)
Congential Adrenal Hyperplasia (17-OHP)	Within Normal Limits (Weight Dependent)
SCID/Primary T-cell lymphopenia	Negative (TREC Present)
X-linked Adrenoleukocystrophy (C26:0-LPC)	Within Normal Limits (>0.4 uM C26:0-LPC)
Lysosomal Disease Profile	Within Normal Limits (Enzyme Activity Present)
Spinal Muscular Atrophy (SMN1 gene)	Within Normal Limits (SMN1 Present)
Congenital cytomegalovirus (cCMV)	Not detected

Critical Values: Any positive or abnormal; MDH Newborn Screening Program staff contact ordering provider or inpatient unit directly.

Limitations: If an infant requires any type of blood transfusion, collect the blood spots before blood products are administered, even if the infant is less

than 24 hours of age. If the pre-transfusion specimen was collected prior to 24 hours of life, a subsequent specimen should be collected after 24 hours. In all instances where a specimen was collected prior to 24 hours of life from an infant weighing less than or equal to 1800 grams, the subsequent specimen can be collected at 14 days of age instead of at the usual 24-48 hours of life.

The first specimen will allow for accurate interpretation for biotinidase deficiency, cystic fibrosis, galactosemia, hemoglobinopathy, and severe combined immune deficiency results. Because these screening results are impacted by transfusions, collecting a blood specimen prior to transfusion is critical in determining whether an infant is at risk for these disorders. The second specimen will be used to screen for the remaining disorders, which are affected by the timing of collection.

If an infant is transfused and a prior specimen was not collected, a specimen should be collected between the optimal time of 24-48 hours of life or as soon as possible, and a second specimen should be collected at 90 days after the last transfusion. The 90-day specimen allows the Newborn Screening Program to accurately interpret those results that are impacted by transfusion.

Methodology:

Congenital Hypothyroidism: TSH/17OHP: fluoroimmunoassay
Congenital Adrenal Hyperplasia: Quantitative time-resolved fluoroimmunoassay
Cystic Fibrosis: Immunoreactive Trypsinogen with PCR follow-up for positives
Galactosemia/Galactose-1 phoshate uridyltransferase: Enzyme by semi-quantitative fluorometric assay; Total Galactose: Quantitative fluorometric assay
Hemoglobinopathies: Isoelectric focusing
Biotinidase: Biotinidase enzyme by qualitative colorimetric assay
Amino Acidemias: Tandem Mass Spectrometry (MS/MS)
Organic Acidemias: Tandem Mass Spectrometry (MS/MS)
SCID: Tandem Mass Spectrometry (MS/MS)
X-linked Adrenoleukodystrophy: Tandem Mass Spectrometry (MS/MS)
Lysosomal Disease Profile: Tandem Mass Spectrometry (MS/MS)
Spinal Muscular Atrophy: Realtime Quantitative PCR (qPCR)
Congenital cytomegalovirus: Realtime Quantitative PCR (qPCR)

References:

Minnesota Department of Health (February 2023)

Updates:

1/17/2006: Added information regarding patients under 1800 grams and collection procedure changes for them.
3/8/2006: Updated with additional information regarding addition of CF to the screen on 3/1/2006. Also the addition of 83516 as the CPT code for this test.
9/30/2008: Heel stick/line draw clarification confirmed by MN Dept of Health.
11/10/2010: Update for collection procedures for specimens > and < 1800 grams.
9/15/2014: Added Limitations explaining the impact of specimen collection timing and transfusions.
12/12/2016: Added info about SCID and X-ALD.
8/2/2017: Added info about Lysomal Disease Profile, newly added testing.
01/22/2018: Added information about Spinal Muscular Atrophy, newly added testing.
2/06/2023: Added Congenital cytomegalovirus (cCMV)
4/21/2023: Updated collection information to the new 6-spot cards