Proposal for

EXPANDED NEWBORN SCREENING
Eastern Biotech & Life Sciences - enables healthier pregnancies, babies & families worldwide
INTRODUCTION

The miracle of birth brings to families a sense of pride and hope for the future. A newborn baby is very important to parents and knowing that their new baby is healthy is vital. The baby’s paediatrician can offer much needed reassurance by thorough assessment of the baby’s health after a comprehensive laboratory analysis of the baby’s metabolism by heel prick analysis. After a careful medical history and physical examination are completed, laboratory studies provide a wealth of information unavailable by any other means. For newborn babies, the number of medical conditions detectable within the first month of life has risen dramatically due to advances and refinement in laboratory technologies. Ultimately, the purposes of expanding newborn screening programs are as follows:

1. To reduce suffering and untimely death from newborn disorders,

2. To reduce parental anxiety and loss of work time caring for a chronically ill child, and

3. To lessen societal costs in terms of health care, special education, and loss of productivity due to workforce reduction (resources devoted to caring for a sick child).

Hospitals in the UAE have started to realize the benefits of screening newborn infants for metabolic disorders, similar to the practices in the West. The incidence of metabolic disorders in the UAE and the Middle East is much higher than the general incidence rates due to higher rates of consanguinity in the regions. The benefit of NBS is that when detected early and treated immediately, these babies will lead a normal healthy life to adulthood and beyond. As the nation’s largest provider of newborn screening services, Eastern Biotech is dedicated to improving the lives of children and their families by offering early detection of metabolic and other inherited disorders. Metabolic and other inherited disorders are rare, but can be harmful, and even deadly, when undetected and untreated.

In GCC regions, the Kingdom of Saudi Arabia already has a comprehensive Newborn Screening Program (NBS) for their citizens.

Eastern Biotech offers a screening service that determines a baby’s risk for more than 48 inherited disorders through an easily collected blood spot sample.

The span of technology and services provided by our laboratory differentiates us from others performing similar testing. We pride ourselves being a pioneer in utilizing a combination of tandem mass spectrometry (MS/MS) and biochemical analysis, all integrated with strong software to ensure timely, accurate results for samples tested.
Newborn Screening Technique

The ideal time to perform a sample collection for a screen is 1 to 7 days after birth. Samples may also be collected after the initial 7 days until adulthood if necessary. The samples are collected on a special filter paper, Whatman 903, using a simple technique called the "Heel Prick."

Newborn Screening Process and Reporting

The process for screening is simple, but it must be coordinated by a physician. Eastern Biotech will provide certified sample collection cards from Whatman along with special newborn screening "heel prick" lancets. A healthcare professional will take a small sample of blood by pricking baby's heel and place it on the absorbent filter paper provided by us. After the sample dries, it is sent to our lab where professionals use different screening methods and equipment to analyze the sample.

A newborn testing positive for a metabolic disorder takes the highest priority. In this case, the physician and/or the parent will be notified of the results immediately and offered guidance and resources for next steps. The physician is also provided with extensive details of the disorder and information on the treatment and names of metabolic disorder specialists.

Reports of normal results will be available within 5-7 days of the sample reaching the lab. A sample report is provided in the Appendix.

Treatment Resources & Follow Up

Our strengths are in supporting physicians with treatment resources and follow up help when a metabolic disorder has been identified in a baby. We have a list of metabolic experts who focus on metabolic disorders and, if requested, we will set up meetings with the experts, on behalf of the physician.

We also have a list of laboratories for the physicians for confirmatory testing. We will also work with the parents and physicians to get access to the special diets, if needed. Eastern Biotech does not treat metabolic disorders. We will support the physician in his or her efforts in treating the affected individual.

Program Implementation

We need one week time to start actually processing of samples in our lab before we will have one small workshop for Sample Collection procedure for technicians and nurses.

Training

The success of the program depends on informing and educating physicians and healthcare workers on newborn screening. Gynecologists play an important role in informing expectant mothers of the newborn screening test and its benefits. Pediatricians need to be familiar with the "Heel Prick" to collect the sample from a newborn. They also need to be aware of the treatments and resources that are available to them to treat a newborn, if a disorder is detected. Most often nurses or other health professionals take the sample from the newborn and they need to be trained on the Heel Prick.
Congenital Adrenal Hyperplasia (CAH)
CAH is a group of disorders caused by the deficiency of an adrenal enzyme resulting in decreased production of two important hormones. One helps the body respond to stressful events, and the other helps maintain body fluids and salts. Without enough of these hormones, affected newborns may appear normal, but can quickly develop symptoms including lethargy, vomiting, muscle weakness and dehydration. In severe cases death may occur within a few weeks if left untreated. Infants with milder forms of the disorder are at risk for reproductive and growth difficulties. If detected early, and treated well with medication, affected infants should have normal growth and development.

Galactosemia (GALT)
Galactosemia results from a deficiency in the enzyme needed to metabolize galactose, a milk sugar. Newborns typically appear normal; however, within a few days to two weeks after initiating milk feedings, vomiting, diarrhea, lethargy, jaundice and liver damage develop. Untreated, the disorder may result in developmental retardation, liver enlargement, growth failure, cataracts, and, in severe cases, death. With early detection and strict adherence to a galactosefree diet, affected infants can be expected to achieve satisfactory general health.

Phenylketonuria (PKU)
Phenylketonuria is the result of an inability to break down the amino acid, phenylalanine, found in food protein. Infants may appear normal in the first few months of life, but left untreated, PKU can cause mental and motor retardation, an underdeveloped brain, poor growth rate, and seizures. With early detection and proper dietary treatment, growth and development should be normal. Hyperphenylalaninemia can occur in several forms, some mild, some very severe. The severe form is referred to as PKU. The milder form is sometimes called “benign hyperphenylalaninemia” (H-Phe).

Congenital Hypothyroidism (CH)
Congenital hypothyroidism is due to an inability to produce adequate amounts of thyroid hormone. Left untreated, this congenital deficiency of thyroid hormone can result in mental retardation and stunted growth. Newborns may appear normal up to three months of age. If detected early (before three weeks) and maintained on appropriate levels of thyroid hormone medication, infants diagnosed with CH should have normal growth and development.
Maple Syrup Urine Disease (MSUD)
Maple Syrup Urine Disease is an enzyme deficiency disorder. Newborns typically appear normal, but by the first week of life can experience feeding difficulties, lethargy, and failure to thrive. Left untreated, MSUD can lead to progressive neurological problems, acidosis, seizures, and sudden breathing cessation that can rapidly lead to coma and death. Severe effects can be avoided with early detection and treatment. Strict dietary management, dietary supplements, and close developmental monitoring and assessment are needed.

Organic Acid Disorders (OAD)
Organic acidemias are a group of inherited metabolic disorders that lead to accumulation of organic acids in biological fluids, e.g., blood and urine. The accumulation disturbs the acidity of the body and causes alterations in metabolic chemical reactions. These disorders can cause intoxication-like symptoms such as vomiting, dehydration, and coma. Some patients may have too little sugar, too much lactic acid, or too much ammonia in the blood. Chronic symptoms include recurrent vomiting, failure to thrive, floppiness and general developmental delay. Symptoms can be diminished by restricting protein in the diet and, in some cases, supplementation with vitamins and/or carnitine. These disorders include 8 Core Conditions (GA-1, HMG, IVA, 3-MCC, CBL-A,B, BKT, MUT, PROP, and MCD), and 6 Secondary Conditions (2M3HBA, 2MBG, 3MGA, Cbl-C, D, IBG, and MAL).

Fatty Acid Oxidation Disorders (FAOD)
Fatty Oxidation Disorders are genetic metabolic deficiencies in which a missing or malfunctioning enzyme prevents the body's oxidizing (breakdown) of fatty acids to make energy. The body's main energy source is a sugar, glucose. When glucose runs out, fat normally is broken down into energy. However, that energy is not readily available to children and adults with a fatty acid disorder. Undiagnosed and untreated, these disorders can lead to serious complications affecting the liver, heart, and eyes; general muscle development; and possibly to death. Symptoms of a metabolic "crisis", sometimes stress-induced, include vomiting, diarrhea, lethargy and difficulty breathing. These disorders include 5 Core Conditions (CUD, LCHAD, MCAD, TFP, VLCAD) and 8 Secondary Conditions (CACT, CPT-1a, CPT-2, DE-RED, GA-2, MCKAT, M/SCHAD, and SCAD).

Amino Acid Disorders (AAD)
Amino acid metabolism disorders are a group of inherited conditions in which protein metabolism is disrupted. Onset of symptoms may occur shortly after birth or after an apparently normal neonatal period. The symptoms may occur in episodes with normal periods in between. The clinical onset may include unusual urine odors, irritability, poor feeding, changes in muscle tone, lightened pigmentation, failure to thrive, jaundice, or liver enlargement. Other symptoms include vomiting, lethargy, seizures, and coma. Treatment of amino acid metabolism disorders includes a low-protein diet strictly controlling intake of specific amino acids. Amino acid disorders include 6 Core Conditions (ASA, C17-1, HCY, MSUD, PKU, and TYR-1) and 8 Secondary Conditions (ARG, BIOPT-BS, BIOPT-RG, C17-2, H-PHE, MET, TYR-2, and TYR-3).
Eastern Biotech
Newborn Screening Panel

DISORDERS DETECTED BY TANDEM MASS SPECTROMETRY

ACYLCARNITINE PROFILE

Fatty Acid Oxidation Disorders
- Carnitine / Acylcarnitine Translocase Deficiency
- Carnitine Palmitoyl Transferase Deficiency Type II
- 3-Hydroxy Long Chain Acyl-CoA Dehydrogenase Deficiency
- 2,4-Dienoyl-CoA Reductase Deficiency
- Medium Chain Acyl-CoA Dehydrogenase Deficiency
- Multiple Acyl-CoA Dehydrogenase Deficiency
- Neonatal Carnitine Palmitoyl Transferase Deficiency Type II
- Short-chain Acyl-CoA Dehydrogenase Deficiency
- Short-chain Hydroxy Acyl-CoA Dehydrogenase Deficiency
- Trifunctional Protein Deficiency
- Very Long Chain Acyl-CoA Dehydrogenase Deficiency

Amino Acid Disorders
- Argininemia
- Arginosuccinic Aciduria
- E-Deroprolinuria
- Carnitine:phosphate Synthetase Deficiency
- Citrullinemia
- Homocystinuria
- Hypermethioninemia
- Hyperammoninemia, Hyperornithinemia,
- Homocitrullinuria Syndrome
- Hyperammoninemia with Gyri Atrophy
- Maple syrup disease
- Phenylketonuria
  - Classical / Hyperphenylalaninemia
  - Bioperin Cofactor Deficiencies
- Tyrosinemia
  - Transient Neonatal Tyrosinemia
  - Tyrosinemia Type I
  - Tyrosinemia Type II
  - Tyrosinemia Type III

Organic Acid Disorders
- 3-Hydroxy-3-Methylglutaryl-CoA Lyase Deficiency
- Glutaric Acidemia Type I
- Isobutyryl-CoA Dehydrogenase Deficiency
- Isovaleric Acidemia
- 2-Methylbutyryl-CoA Dehydrogenase Deficiency
- 3-Methylcrotonyl-CoA Hydratase Deficiency
- 3-Methylglutaconyl-CoA Hydratase Deficiency
- Methylmalonic Acidemias
  - Methymalonyl-CoA Mutase Deficiency
  - Some Adenosylcobalamin Synthesis Defects
  - Maternal Vitamin B12 Deficiency
- Mitochondrial Acetoacetyl-CoA Thiolase Deficiency
- Propionic Acidemia
- Multiple CoA Carboxylase Deficiency
- Malonic Aciduria
Newborn screening tests are vital in the monitoring of child health and obtaining quality blood specimens is a critical part of the process. The blood sample is collected from a specific area of the baby’s foot and applied to specialized filter paper strip attached to the requisition form.

**Sample Collection**

The sample should be drawn by a health professional experienced in this type of collection. Specimens should be obtained between 24 and 48 hours of age, as close to 48 hours as possible.

- Sterilise the heel area with alcohol, air dry, and puncture with a sterile disposable lancet.
- Apply blood to the front side of the filter paper only.
- Completely fill each of the four circles on the filter paper with a single, free flowing drop of blood.
- Make sure the blood soaks through to the back of the filter paper.
- Do not layer successive drops.
- The use of capillary tubes is not recommended. Do not use devices that contain EDTA, citrate, or oxalate.
- Air dry on a clean flat surface for three to four hours away from heat and light.
- Do not stack or allow the blood spots on the filter paper to touch other surfaces while drying.
- When dry, return the fold over flap to its original positions.
EASTERN BIOTECH-BRINGING GLOBAL EXPERTISE TO UAE

EASTERN BIOTECH Health Sciences is a state of the art specialty centre focused on biochemical screening and confirmatory tests that are indicators for fetal, maternal and newborn genetic diseases.

Health baby
- ACYL Carnitine Profile
- Amino Acid Profile
- Galactosemia
- Congenital Hypothyroidism
- Congenital Adrenal Hyperplasia
- G6PD
- Cystic Fibrosis
- Biotinidase
- Hemoglobinopathies (Hemoglobin S-Beta Thalassemia, Hemoglobin S/C Disease, Hemoglobin Variants (HbE, HbD, HbC), Sickle Cell Disease)

Health pregnancy
- First trimester screening for Down Syndrome and other trisomies
- Second trimester screening
- Classical cytogenetics and FISH assays
- Shortly introducing TM BACs-On-Beads (BoB’s) in Molecular Genetics

Healthy family
- Genetic Testing

www.geneticcounseling.ae | www.trigene.ae
FOLLOWING INTERNATIONAL GUIDELINES

- CDC Atlanta for newborn screening
- FMF UK for first trimester screening
- UK NEQAS for prenatal screening

SHORTLY INTRODUCING:

- Mass spectrometry for expanded newborn screening
- Haemoglobinopathy testing for sickle cell anaemia and thalassemia
- Molecular Genetics BACs-On-Beads (BoB’s)TM for fast, precise and cost-effective targeted molecular karyotyping