

## Table of Contents

<i>Introduction</i> .....	2
<i>About Our Diagnostic Laboratory</i> .....	4
<i>Genetic Counseling</i> .....	5
<i>Indications for Genetic Testing</i> .....	6
<i>Prenatal Screening Laboratory</i> .....	9
<i>Cytogenetics Laboratory</i> .....	11
<i>Molecular (DNA) Diagnostic Laboratory</i> .....	12
<i>FISH Laboratory</i> .....	14
<i>Test Menu</i> .....	16
<i>Test Requisitions</i> .....	20

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## INTRODUCTION TO SERVICES

Fifty years ago, scientists were seeking the answer to a complex question: what is a gene? Much progress has been made since then. From the 1953 discovery of deoxyribonucleic acid, or DNA, the material from which genes are made, the road was paved to virtually everything that constitutes modern human genetic study. Today, physicians and scientists from University Hospitals Case Medical Center are on the forefront of what has been called one of the most profound developments of medical science. Through the combined efforts of our own experts and their colleagues throughout the world, we are poised on the verge of discovering not only ways to test for the presence of genetic disease but, eventually, new ways to prevent or even cure disease right at its source.

The Center for Human Genetics, a unique collaboration between clinicians and counselors of University Hospitals Physicians Services and scientists and laboratorians of University Hospitals Laboratory Services Foundation, is your link to this promising new era in human genetics. The Departments of Genetics and Pathology work closely together to provide a comprehensive patient care experience, coordinating clinical evaluations with diagnostic laboratory services. Our interdisciplinary center brings together a multitude of medical, clinical, biochemical and molecular geneticists, genetic counselors, and scientists. This team of specialists is supported by state-of-the-art technology at the Center for Human Genetics Laboratory that focuses on prenatal screening, clinical and molecular cytogenetics, and molecular diagnostic testing.

### *Who should consider consulting a specialist in genetics?*

You or your patient may benefit from consulting genetics if anyone in the family has conditions such as the following:

- Mental retardation/Developmental Delay
- Birth defects (i.e. polydactyly, neural tube defects, heart defects, cleft lip/palate)
- Multiple unusual features or multiple minor anomalies
- Skeletal dysplasias or connective tissue disorders (affecting bones, tendons, or ligaments)
- Unusual growth patterns (tall, short, abnormal limb lengths)
- Disorders of internal organs (heart defects, kidney or brain abnormalities, etc)
- Ambiguous genitalia
- Neurological disorders (hypotonia/muscle weakness, ataxia, seizures)
- Familial and non-familial cancers (multiple family members affected, early age-of-onset, lymphomas, leukemia, breast/ovarian/colon cancer, etc.)

## INTRODUCTION TO SERVICES

- Reproductive abnormalities (recurrent pregnancy loss, stillbirths, infertility)
- Increased risk of having a child with a genetic disorder: family history of a genetic condition, advanced maternal age, exposure to potentially harmful substances or infections during pregnancy, couples at higher risk for certain conditions (for example: Northern European and Cystic Fibrosis, Ashkenazi Jewish and Tay Sachs disease, African Americans and Sickle Cell disease)
- Known chromosomal abnormalities or genetic condition in the family
- Fetal anomalies detected by ultrasound

### *Why should you consult or make a referral to genetics?*

A genetics evaluation can lead to a diagnosis that may explain the reasons for an individual's physical, behavioral, and/or developmental problems. This is often helpful for the family, providing them with answers to previously unanswered questions. In addition, a genetic diagnosis can provide the basis for appropriate treatment and medical management of a certain condition.

About 5% of babies are born with a birth defect or hereditary problem and many other conditions such as cancer and susceptibility to infections are being found to have a strong genetics component. This knowledge is drastically changing how genetics is playing a role in today's health care.

With rapidly advancing technology, it is nearly impossible for families (and even physicians) to keep up with new genetic testing, research, and treatments. Families with a previously diagnosed genetic condition may benefit from meeting with a geneticist and/or genetic counselor to review prognosis, inheritance, and testing options.

## INTRODUCTION TO SERVICES

### *About Our Diagnostic Laboratory*

The Center for Human Genetics includes state-of-the-art laboratories and has offered genetic screening and diagnostic testing for numerous genetic conditions for more than 25 years. The Laboratory combines clinical practice with genetic research allowing it to offer physicians and their patients advanced, innovative diagnostic testing. In addition, as an assurance of its quality, the Laboratory is certified by the College of American Pathologists (CAP) and approved by the Clinical Laboratory Improvement Amendments (CLIA). The Laboratory consists of three related sections:

The Laboratory consists of three related sections:

- Prenatal Screening Laboratory
- Cytogenetics/FISH Laboratory
- Molecular Diagnostic Testing Laboratory

These laboratories work together to offer a comprehensive genetic evaluation for each and every patient.

- The Prenatal Screening Laboratory provides testing and interpretation for the routine Triple/Quad Check usually performed between 15-24 weeks of gestation. The Triple Check uses three markers found in the mother's blood (AFP, ue3, hcG), the Quad Check adds another marker (dimeric inhibin-A). Our PSL also offers Cystic Fibrosis Screening as an option for all patients.
- The Cytogenetics Laboratory provides high quality chromosome analysis on a variety of specimens including amniocenteses, chorionic villi sampling, peripheral blood, bone marrow, tumors, and products of conception. Our Senior Cytogenetics Technologists have a combined total of more than 65 years of field expertise. The Cytogenetic Laboratory works in close conjunction with our Fluorescence in Situ Hybridization (FISH) Laboratory to detect specific abnormalities and to delineate complex karyotypes.

Our Fluorescence in Situ Hybridization Lab offers cutting edge molecular diagnostic techniques specific to many higher incidence genetic syndromes and neoplastic disorders. (page 11) Our expertise with FISH technology continues to rapidly develop and expand at our state of the art facility. FISH offers a quick turnaround time, with high levels of specificity and accuracy.

## INTRODUCTION TO SERVICES

- The molecular diagnostic testing laboratory offers a variety of testing by direct DNA analyses using PCR-based methodologies, DNA hybridization, methylation analysis, sequence analysis, and other technologies. The list of tests offered at our full-service molecular laboratory continues to expand. See our test list (page 16) for an alphabetical listing of tests offered.

### *Genetic Counseling*

Genetic counseling services are offered to help patients and physicians interpret genetics test results, research and examine familial history of possible hereditary disease, facilitate testing outside of our laboratory, and also meet with patients and families to provide appropriate counseling regarding testing or test results. To make an appointment with a Genetic Counselor, please call the Center for Human Genetics main clinical services number, (216) 844-3936.

For questions or clarifications regarding sample submission requirements, to arrange courier service for specimen pick up and/or shipping instructions, or for help with any genetics testing not listed in this brochure, please call the Center for Human Genetics Laboratory at (216) 983-1134 to speak with one of our laboratory Genetic Counselors or a member of our office staff.

## INTRODUCTION TO SERVICES

### *Indications for Genetic Testing*

#### ***PRIMARY CARE - PEDIATRICS - INTERNAL MEDICINE - FAMILY PRACTICE***

#### **Karyotype Analysis**

- Mental retardation with unknown etiology
- Multiple congenital anomalies
- Dysmorphic features
- Infertility (male or female)
- Amenorrhea with unknown etiology
- Short stature (male or female)
- Abnormal or ambiguous genitalia
- Pigmentary changes (café-au-lait spots, patches of hyper/hypo-pigmentation)
- Hypotonia

#### **DNA/FISH testing**

- Mental retardation with unknown etiology, especially males
- Hypotonia
- Multiple congenital anomalies
- Abnormal Behaviors
- Seizures
- Leukemia/Cancers
- Breast cancer in Ashkenazi Jewish population
- Colon cancer in Ashkenazi Jewish population
- Heart defects
- Ambiguous genitalia
- History of thrombosis (clotting) or strokes
- Abnormal liver studies, liver disease

## INTRODUCTION TO SERVICES

### *OBSTETRICS - INFERTILITY*

#### Karyotype Analysis

- Couples with two or more miscarriages
- Male and female infertility
- Family history of chromosome abnormality including translocations
- Products of conception: stillborn children or spontaneous miscarriages
- Abnormal Triple/Quad Check
- Abnormal Ultrasound

#### DNA Testing

- Family history of thrombosis (risk increases during pregnancy)

### *HEMATOLOGY – ONCOLOGY*

#### Karyotype Analysis

- Leukemia
- Myelodysplastic/Myeloproliferative conditions/disorders
- Lymphoma
- Neuroblastoma
- Pre/post treatment and/or transplant

#### DNA Testing

- History of thrombosis
- Hereditary Hemochromatosis

### *NEUROLOGY*

- Seizures

## INTRODUCTION TO SERVICES

- Ataxia/Gait disturbances
- Hearing/vision loss
- Dementia/Personality changes
- Mental retardation
- Myoclonus
- Spasticity
- Numbness
- Abnormal MRI/EEG
- Dysarthria / speech abnormalities

## *PRENATAL TESTING*

### Triple Check / Quad Check / First Trimester Screen

- Available for all pregnancies, assesses risk for open neural tube and ventral wall defects, trisomy 21 (Down syndrome), trisomy 18, and pregnancies at risk for certain complications
- Amniotic Fluid AFP and ACHE
- Amniotic Fluid AFP routine for all pregnancies to detect open neural tube or ventral wall defect
- ACHE testing to confirm elevated amniotic fluid AFP

### Karyotype Analysis

- Advanced Maternal Age (>35 years)
- Abnormal Triple Check/Quad Check Results
- Abnormal Ultrasound findings
- Family history of chromosome abnormalities

### DNA Testing

- Fragile X testing if mother is a premutation carrier
- Heart defects
- Testing of fetus for genetic condition in family

## INTRODUCTION TO SERVICES

### *Prenatal Screening Laboratory*

Our Prenatal Screening Laboratory provides testing and interpretation for the routine Triple Check usually performed between 15-24 weeks of gestation. The Triple Check uses three markers found in the mother's blood called alpha-feto protein (AFP), unconjugated estriol (ue3) and human chorionic gonadotropin (hcG).

The Quad Check adds another marker, dimeric inhibin-A. Using all four of these makers, the Quad Check result can help more accurately determine a fetal risk of open neural tube or ventral wall defects, Down syndrome, Trisomy 18, and a few other pregnancy complications. An abnormal Triple Check or Quad Check is also often helpful to determine if an ultrasound or amniocentesis is warranted.

First trimester screening (typically performed between 11-14 weeks gestation) is a test that combines the results of two analytes (freeBeta-hCG and PAPP-A) with a special ultrasound test. The ultrasound is used to measure an area just behind the baby's neck. This measurement is referred to as the nuchal translucency or NT measurement. The results of the analytes combined with the NT measurement can detect approximately 90% of babies with Down syndrome or Trisomy18.

The laboratory also offers the routine amniotic fluid AFP (AFAFP) assay. If an AFAFP level is elevated, the laboratory will facilitate acetylcholinesterase (ACHE) testing which detects over 99% of open neural tube defects and open abdominal wall defects. Triple Check and AFAFP results are usually completed in 1-2 days, Quad Check results in 2-3 days.

### **Required Information for analysis**

Page 22 is a copy of a requisition for the Prenatal Screening Laboratory. Please contact us to obtain additional requisitions by email, fax or traditional mail. Please complete the requisition in its entirety, including the following:

- Patient's name
- Patient's date of birth
- Patient's insurance or billing information

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**INTRODUCTION TO SERVICES**

- Patient's weight (this can affect the values)
- Date of ultrasound (if the patient has had an ultrasound)
- Gestational age (preferably by ultrasound, but last menstrual period can be used as well)
- The Triple Check can be performed between 15-25 weeks gestation.
- Patient's ethnicity or race (as certain ethnic groups have different cut-off values)
- Date of the blood draw
- Whether there is a family history of neural tube defects
- Whether the patient is diabetic
- Whether it is a twin or singleton pregnancy

**Sample Requirements**

A single red top tube of blood or serum separator tube is required for analysis. The sample can be stored in a refrigerator for 1-2 days and should be shipped at room temperature.

## INTRODUCTION TO SERVICES

### *Cytogenetics Laboratory*

The Cytogenetics Laboratory routinely performs chromosomal analysis on amniotic fluid, chorionic villi samples (CVS), peripheral blood, cord blood, skin, bone marrow, and other tissues. This analysis can detect substantial extra or missing genetic material, thus ruling out such things as Down syndrome, chromosomal translocations, and other cytogenetic problems. Such testing may be warranted for high-risk pregnancies (abnormal triple check/quad check, abnormal ultrasound, women over the age of 35), miscarriages, children that are stillborn, children with dysmorphic features, or when there is a family history of a chromosomal abnormality. In addition, cytogenetics can also be performed on bone marrow and/or blood for a number of different cancers to help diagnose particular types of cancer, determine prognosis to help select a treatment, and determine if an individual is benefiting from a recent therapy.

Any abnormal results are immediately called and faxed to the referring physician with recommendations for appropriate follow-up. Experienced professionals can answer questions and can direct calls to obtain test results. Cytogenetic results are usually available in 8-10 days with preliminary results often available in 4-6 days.

The Cytogenetics Laboratory also works in close association with the Fluorescence In-Situ Hybridization (FISH) Laboratory on prenatal and postnatal specimens. FISH can confirm the presence or absence of certain small regions of chromosomes not detected by routine cytogenetics. Please see page 16 for a complete listing of the FISH testing that is currently available.

### **Sample Requirements**

At least 3-5ccs of blood or 2ccs of bone marrow in a green top (sodium heparin) tube is required for a karyotype (chromosome analysis) or any FISH test. Please note that some

tests (Fragile X, Prader-Willi and Angelman syndromes) require both a purple top and green top tube, as these tests require cytogenetics/FISH analysis and Molecular DNA testing. The sample can be stored at room temperature for 1-2 days and can be shipped at room temperature.

Tissues from miscarriages or a fetal demise should be sent in HBSS media or sterile saline. Do NOT freeze or fix specimens. Preferred tissues for miscarriages are (in order of preference): chorionic villi, membrane, or sac. Preferred tissues of a fetal demise are (in

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UNIVERSITY HOSPITALS LABORATORY SERVICES FOUNDATION

INTRODUCTION TO SERVICES

order of preference): lung, deep muscle, achilles tendon, kidney, skin, chorionic villi. Please label each specimen and do not include more than 1-2 cubic centimeters of each tissue.

*Molecular (DNA) Diagnostic Laboratory*

The Molecular Diagnostic Laboratory offers a variety of testing to help diagnose genetic conditions that cannot be diagnosed by routine cytogenetics. By using technology such as PCR sequencing, invader assay and Southern blot analyses, the Molecular laboratory can detect specific DNA mutations for particular genetic conditions. Please see the page 16 for a list of testing that is currently available.

**Sample Requirements**

At least 3-5ccs of blood in a purple top (EDTA) tube is required for molecular tests. Please note that some tests (Fragile X, Prader-Willi and Angelman syndromes) also require a green top tube for the associated cytogenetic component.

## INTRODUCTION TO SERVICES

### *INDICATIONS FOR COMMON MOLECULAR TESTS*

#### **Angelman Syndrome**

Mental retardation  
Ataxia  
Seizures  
Erratic arm movements (hand flapping)  
Unprompted laughter  
Lack of speech

#### **Fragile X Syndrome**

Mental retardation, especially in males  
Long, thin face, protruding jaw, and large ears  
Macroorchidism (large testes)  
Autistic-like and other behavioral problems  
Mitral valve prolapse

#### **Hereditary Hemochromatosis**

Liver dysfunction  
Endocrine dysfunction  
Skin hyper-pigmentation  
Cardiomyopathy  
Arthropathy

#### **Hearing Loss Panel**

Sensorineural hearing loss  
Other hearing loss  
Deafness

#### **Uniparental Disomy**

Translocations or mosaicism involving:  
chromosomes 6, 7, 14 and 15

#### **Metabolic Disorders**

Confirmation of a clinical/biochemical diagnosis of:  
Pyruvate Dehydrogenase deficiency  
Dihydrolipoamide Dehydrogenase deficiency  
Fumarase deficiency

#### **Prader-Willi Syndrome**

Severe hypotonia  
Mental retardation  
Obesity/hyperphagia  
Abnormal genitalia

#### **Quantitative PCR for BCR/ABL**

Known or suspected CML  
Known or suspected AML  
Known or suspected ALL

#### **SRY/Testis Determining Factor**

Ambiguous or abnormal genitalia  
Discrepant gender identification

#### **Thrombosis Panel**

##### **(Factor V Leiden, MTHFR, Prothrombin)**

Thrombosis events  
Stroke / Premature cardiovascular disease  
Elevated homocysteine levels  
Pre-eclampsia

## INTRODUCTION TO SERVICES

### *FISH Laboratory*

Our Fluorescence in Situ Hybridization Lab offers cutting edge molecular diagnostic techniques specific to many higher incidence genetic syndromes and neoplastic disorders. Our expertise with FISH technology continues to rapidly develop and expand at our state of the art facility. FISH offers a quick turnaround time, with high levels of specificity and accuracy. Please see page 16 for a comprehensive listing of available FISH tests.

### Sample Requirements

As with routine cytogenetics, FISH testing requires at least 3-5ccs of blood or 2ccs of bone marrow in a green top (sodium heparin) tube.

**AneuVysion™**, a commonly prescribed prenatal FISH test can be **performed on an amniocentesis** to detect aneuploidy in chromosomes 13, 18, 21, X, and Y. These results can be ready in 24-48 hours. This test is often appropriate when the patient is of late gestational age, or Trisomy 13, 18, 21 (Down syndrome), Turner syndrome, or ambiguous genitalia is suspected. Also, if an elevated risk of any of these conditions is detected during routine Triple Check or Quad Check testing, Aneuvysion may be requested.

The **UroVysion™** assay is a genetic test designed for recurrence of transitional cell carcinoma of the bladder by detected aneuploidy for chromosomes 3, 7, 17 and the loss of the 9p21 locus. UroVysion, along with cystoscopy, is a noninvasive test for monitoring recurrence in patients diagnosed with bladder cancer. **UroVysion requires voided urine**, in an amount greater than 33 ml. Mix voided urine 2:1 with Carbowax preservative and ship on ice packs immediately or refrigerate and ship on ice packs within 24 hours. Samples must be received by the Center for Human Genetics Laboratory within 72 hours of collection. UroVysion collection kits can be obtained by contacting the Center for Human Genetics at (216) 983-1134.

INTRODUCTION TO SERVICES

***INDICATIONS FOR COMMON FISH TESTS***

**AneuVysion™ (supplemental amniocentesis test)**

Allows for rapid count of chromosomes:

13, 18, 21, X and Y

Later gestation pregnancies

Advanced maternal age

Abnormal Ultrasound

Abnormal Triple/Quad screen result

**Cri-du-Chat Syndrome (5p- syndrome)**

Cat-like cry in infancy

Mental retardation

Multiple congenital anomalies

Heart defects

**DiGeorge/Velocardiofacial Syndromes (22q11)**

Velopharyngeal insufficiency / cleft palate

Hypernasal speech

Heart defects (prenatal or postnatal)

Tetralogy of Fallot

Learning disabilities

Absent or hypoplastic thyroid gland

Immune deficiency (abnormal T cell function)

**Miller-Dieker Syndrome (17p13)**

Lissencephaly

Mental retardation

Facial dysmorphism

**Retinoblastoma (13q14)**

Detects deletion in 5-10% of patients

Unilateral or bilateral eye tumors

**Smith-Magenis Syndrome (17p11)**

Abnormal and self-injurious behaviors

Abnormal sleep patterns

Hoarse Voice

Mental retardation

Facial dysmorphisms

**Williams Syndrome (7q11.23)**

Distinctive "cocktail" personality

Prominent lips

Hoarse voice

Heart defects (pulmonary hypoplasia)

Mental retardation

Stellate pattern in iris

**Wolf-Hirschhorn Syndrome (4p-)**

Mental retardation

Failure to thrive

Retarded growth

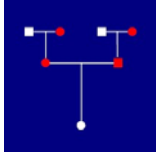
Seizures

Facial dysmorphism

**UroVysion™ (bladder cancer test)**

Hematuria

Known or suspected bladder cancer



Cytogenetics (G-banding or chromosomal/karyotype analysis)

- Amniotic Fluid (with or without Aneuvysion FISH)
- Chorionic Villi Sample (with or without Aneuvysion FISH)
- Products of Conception
- High Resolution Peripheral Blood (Constitutional)
- Bone Marrow Aspirate
- Peripheral Blood, Leukemic
- Lymph Node

FISH Testing

*For constitutional rearrangements:*

- 1p36 Deletion Syndrome
- Angelman Syndrome
- AneuVysion™
- Cri-du-chat (5p-) Syndrome
- DiGeorge/Velocardiofacial Syndrome
- Kallman Syndrome
- Miller-Dieker Syndrome
- Prader-Willi Syndrome
- Smith-Magenis Syndrome
- Sotos Syndrome
- Steroid Sulfatase Deficiency
- Williams Syndrome
- Wolf-Hirschorn (4p-) Syndrome
- X-linked Ichthyosis
- Delineation of unique, de novo chromosomal abnormalities by BAC FISH

*For acquired abnormalities:*

Myeloid diseases (MDS, AML, MPD)

- 5/5q-
  - 7/7q-
  - trisomy 8
  - deletion 13q
  - deletion 20q
- } each separately or as an MDS panel

## Myeloid diseases (continued)

t(8;21) (AML M2)  
t(15;17) (APL)  
inv(16)(p13q22); t(16;16)(p13;q22)/del (16)(q22) (AML-M<sub>4</sub>Eo)  
11q23 (AML M5)  
t(9;22)(q34;q11.2) (CML)

## Lymphoid diseases (myeloma, CLL/SLL, NHL, ALL)

deletion 13q14	}	separately or as a myeloma panel
deletion 13q14.3		
deletion 17p13.1		
rearrangement of 14q32		
deletion 6q23	}	separately or as a CLL/SLL panel
deletion 11q22.3		
deletion 13q14		
deletion 13q34		
deletion 17p13.1		
trisomy 12)	}	separately or as a pre-B ALL panel
t(4;14) (Myeloma)		
t(11;14) (Mantle Cell)		
t(14;18) (follicular/diffuse)		
t(8;14) (Burkitt's lymphoma)		
trisomies 4, 10 and 17		
t(9;22)		
t(12;21)		
11q23		

## Sex Chromosomes (X/Y) Post-Transplant UroVysion™

### Prenatal Screening

AFP (Amniotic Fluid)  
AFP (Blood Serum)  
Triple Screen (AFP, βHCG, Estriol)  
Quad Screen (AFP, βHCG, Estriol, Inhibin)  
First Trimester Screening (free β hCG, PAPP-A + NT measurement)

## Molecular Testing

Angelman Syndrome / Prader Willi Syndrome (Methylation Analysis)

Ashkenazi Jewish Carrier Screening (8 diseases, separately or as a panel)

Bloom Syndrome

Canavan Disease

Familial Dysautonomia

Fanconi Anemia Group C

Gaucher Disease

Mucopolidosis Type IV

Niemann-Pick Disease

Tay Sachs

Chimerism (Pre & Post Transplant Analysis)

Connexin 26 Sequencing

Connexin 30 (GJB6) Sequencing

Connexin 30 (GJB6) Deletion Analysis

DLD (Dihydrolipoamide Dehydrogenase) Gene Sequencing

DLD (Dihydrolipoamide Dehydrogenase) Known Familial Mutation

DLD (Dihydrolipoamide Dehydrogenase) Prenatal

DLAT (Dihydrolipoamide S-Acetyltransferase) Gene Sequencing

DLAT (Dihydrolipoamide S-Acetyltransferase) Known Familial Mutation

DLAT (Dihydrolipoamide S-Acetyltransferase) Prenatal

Cystic Fibrosis Carrier Screening

FH (Fumarate Hydratase) Gene Sequencing

FH (Fumarate Hydratase) Known Familial Mutation

FH (Fumarate Hydratase) Prenatal

Fragile X Syndrome (PCR and Southern Blot analysis)

Hemochromatosis

Factor V Leiden /Factor V HR2

Prothrombin

MTHFR

} separately or as a Thrombophilia Panel

MTRNR1/MTTS1 Sequence Analysis

(Mitochondrial & Aminoglycoside-induced Hearing Loss/Deafness)

PC (Pyruvate Carboxylase) Gene Sequencing

PC (Pyruvate Carboxylase) Known Familial Mutation

PC (Pyruvate Carboxylase) Prenatal

PDHA1 (Pyruvate Dehydrogenase, E1-Alpha Deficiency) Gene Sequencing

PDHA1 (Pyruvate Dehydrogenase, E1-Alpha Deficiency) Known Familial Mutation

PDHA1 (Pyruvate Dehydrogenase, E1-Alpha Deficiency) Prenatal

## Molecular testing (continued)

PDHB (Pyruvate Dehydrogenase, E1-Beta Deficiency) Gene Sequencing

PDHB (Pyruvate Dehydrogenase, E1-Beta Deficiency) Known Familial Mutation

PDHB (Pyruvate Dehydrogenase, E1-Beta Deficiency) Prenatal

PDHX (Pyruvate Dehydrogenase, E3-Binding Protein (Component X)) Gene Sequencing

PDHX (Pyruvate Dehydrogenase, E3-Binding Protein (Component X)) Known Familial Mutation

PDHX (Pyruvate Dehydrogenase, E3-Binding Protein (Component X)) Prenatal

Quantitative PCR for BCR/ABL Fusion Transcripts

UPD studies

    Angelman Syndrome/Prader Willi Syndrome

    UPD14 syndrome

    Russell Silver

    Transient Neonatal Diabetes

Y deletion (male infertility)

Zygoty

**SPECIMEN INFORMATION**

\*Collection date \_\_\_\_\_ Institution \_\_\_\_\_ Phlebotomist \_\_\_\_\_  
 Peripheral Blood  Cord Blood from (Circle) Liveborn / Stillborn/Demise/Ongoing Pregnancy  DNA  Tissue  Other \_\_\_\_\_

**PATIENT INFORMATION**

Name (Last, First): \_\_\_\_\_

DOB: \_\_\_\_/\_\_\_\_/\_\_\_\_ Medical Record Number: \_\_\_\_\_

Address: \_\_\_\_\_ Phone: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_ SS #: \_\_\_\_/\_\_\_\_/\_\_\_\_

Sex:  Male  Female  Ambiguous  Unknown Pregnant: Yes / No Gestational age: \_\_\_\_\_

Ethnicity:  Caucasian (N. and S. European)  Ashkenazi Jewish  Hispanic  Asian  Afr. American  Other: \_\_\_\_\_

**REFERRING PHYSICIAN**

Name \_\_\_\_\_ Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

Name & Phone of person completing requisition: \_\_\_\_\_  Informed consent obtained (if appropriate)

**BILLING INFORMATION**

Bill: \* Insurance  Referring Institution  Check enclosed for \$ \_\_\_\_\_

\* If Insurance will be billed, please attach a copy of current insurance card (front and back), which should include:  
Patient Name, Insurance Provider address & phone #, Policy #, Group #, Relationship to Patient

**TEST INDICATION**

ICD9 CODES (Required): \_\_\_\_\_

**CYTOGENETICS TESTS**

(5mL in green top Sodium-Heparin Tube)

- CHROMOSOME ANALYSIS, HIGH RESOLUTION  
(also known as karyotype or cytogenetics)
  - With five-cell, lower resolution preliminary result called within 48-72 hours  
(extra charge, done for newborns only)
  - With extra 10 counts for sex-chromosome mosaicism  
(used with Q. 45,X or Q. 47,XXY)
- FISH with selected probe(s)  
Probe: \_\_\_\_\_
- Other \_\_\_\_\_

**MOLECULAR TESTS**

(5mL in purple top EDTA Tube)

- Hearing Loss Panel
  - Aminoglycoside Induced Deafness
  - Connexin 26 (sequencing)
  - Connexin 30 (deletion testing)
- Thrombophilia Panel
  - Factor V Leiden Mutation
    - Reflex to Factor V HR2 if Needed
  - Prothrombin Mutation Analysis
  - MTHFR C677T Mutation Analysis
- Hereditary Hemochromatosis
- Uniparental Disomy, Chrom # \_\_\_\_\_
- Y Deletion for Male Infertility
- Zygosity
- Cystic Fibrosis Carrier Screen  
(41 Mutations)
- DNA Extract/Store
- Other \_\_\_\_\_

**COMBINED PANELS**

(5mL in purple top EDTA & 5 mL in green top)

- Fragile X Syndrome Analysis  
(Both tests done unless otherwise specified)
  - Molecular Analysis ONLY
  - Chromosome Analysis ONLY
- Prader-Willi Syndrome Analysis  
(Both tests done unless otherwise specified)
  - Methylation Analysis ONLY
  - Chromosome Analysis + FISH ONLY
- Angelman Syndrome Analysis  
(Both tests done unless otherwise specified)
  - Methylation Analysis ONLY
  - Chromosome Analysis + FISH ONLY

# CENTER FOR HUMAN GENETICS LABORATORY

University Hospitals Laboratory Services Foundation

W.O. Walker Center, 6<sup>th</sup> Floor

10524 Euclid Avenue

Cleveland, OH 44106 Tel: (216) 983-1134 Fax: (216) 983-1144

# Cytogenetics and Molecular Genetics Requisition (for Cancer Specimens)

Medical Record Number: \_\_\_\_\_

## SPECIMEN INFORMATION

**Type:**  Peripheral Blood  Bone Marrow  Lymph node  Solid Tumor (specify) \_\_\_\_\_  Other (specify) \_\_\_\_\_

**★ Date of specimen collection:** \_\_\_\_\_ **★ Where drawn (institution):** \_\_\_\_\_

Post-treatment Y / N Date of last treatment \_\_\_\_\_ Medication/treatment used \_\_\_\_\_

## PATIENT INFORMATION

Name (Last, First) \_\_\_\_\_ Phone (H) (\_\_\_\_) \_\_\_\_\_ DOB \_\_\_\_/\_\_\_\_/\_\_\_\_

Address \_\_\_\_\_ (W) (\_\_\_\_) \_\_\_\_\_ SS# \_\_\_\_-\_\_\_\_-\_\_\_\_

City/State/Zip \_\_\_\_\_ Sex:  Male  Female

**★ Transplant patient Y/N**  Donor  Recipient **★ Sex of transplant match:**  Male  Female

## REFERRING PHYSICIAN

Name \_\_\_\_\_ Results also sent to \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

## BILLING INFORMATION

**Bill:**  Insurance  Referring Institution  Patient  Other Party

Ins.Co./Instit. \_\_\_\_\_ Name \_\_\_\_\_

Please attach appropriate billing information if available

## INDICATIONS FOR TESTING (ICD9 Codes are in parentheses)

- |   |   |
|---|---|
| <input type="checkbox"/> Acute lymphocytic leukemia (ALL) (204.00)          | <input type="checkbox"/> Lymphoproliferative disorder (238.79)                  |
| <input type="checkbox"/> Acute myelocytic leukemia (AML)(205.00)            | <input type="checkbox"/> Monoclonal Gammopathy (273.1)                          |
| <input type="checkbox"/> Acute promyelocytic leukemia (APL) (205.00)        | <input type="checkbox"/> Plasma Cell Dyscrasia (273.9)                          |
| <input type="checkbox"/> Anemia (suspected leukemia) (285.9, 208.80)        | <input type="checkbox"/> Multiple Myeloma (203.00)                              |
| <input type="checkbox"/> Burkitt's Lymphoma (200.20)                        | <input type="checkbox"/> Myelodysplastic Syndrome (288.75)                      |
| <input type="checkbox"/> Chronic myelogenous leukemia (CML) (205.10)        | <input type="checkbox"/> Myelofibrosis (suspected leukemia) (289.83, 208.80)    |
| <input type="checkbox"/> Chronic lymphocytic leukemia (CLL) (204.10)        | <input type="checkbox"/> Myeloma (203.0)  |
| <input type="checkbox"/> Hodgkin's Lymphoma (201.9)                         | <input type="checkbox"/> Myeloproliferative Syndrome (238.79)                   |
| <input type="checkbox"/> Non-Hodgkin's Lymphoma (202.80)                    | <input type="checkbox"/> Neutropenia (suspected leukemia) (288.0, 208.80)       |
| <input type="checkbox"/> Lymphoma (202.80)                                  | <input type="checkbox"/> Pancytopenia (suspected leukemia) (284.0, 208.80)      |
| <input type="checkbox"/> Leukemia (known or suspected) (208.80)             | <input type="checkbox"/> Polycythemia vera (suspected leukemia) (238.4, 208.80) |
| <input type="checkbox"/> Leukopenia (suspected leukemia) (288.0, 208.80)    | <input type="checkbox"/> Thrombocytopenia (suspected leukemia) (287.5, 208.80)  |
| <input type="checkbox"/> Leukocytosis (suspected leukemia) (288.8, 208.80)  | <input type="checkbox"/> Thrombocytosis (suspected leukemia) (289.9, 208.80)    |
| <input type="checkbox"/> Lymphocytosis (suspected leukemia) (288.8, 208.80) | <input type="checkbox"/> Other _____  |

## TEST REQUESTED

### Cytogenetics: (Requires heparinized sample or Green Top tube)

Chromosome Analysis

### FISH: (Requires heparinized sample or Green Top tube)

FISH for previous abnormality ★

- |  |   |  |
|--|---|--|
| <input type="checkbox"/> t(8;21) (AML, ETO/AML1)                           | <input type="checkbox"/> Myeloma Panel (including the following)  | <input type="checkbox"/> MDS Panel (including the following)     |
| <input type="checkbox"/> t(9;22) (CML and ALL, BCR/ABL)                    | <input type="checkbox"/> t(4;14) (FGFR3/IGH)                      | <input type="checkbox"/> -5/5q- <input type="checkbox"/> 13q-    |
| <input type="checkbox"/> t(15;17) (APL, PML/RAR $\alpha$ )                 | <input type="checkbox"/> -13/13q- (D13S319, LAMP1)                | <input type="checkbox"/> -7/7q- <input type="checkbox"/> 20q-    |
| <input type="checkbox"/> Inv 16/t(16;16)/del16 (AML-M <sub>4</sub> , CBFB) | <input type="checkbox"/> 17p- (p53)                               | <input type="checkbox"/> +8                                      |
| <input type="checkbox"/> 9p-, +9 (p16 probe)                               | <input type="checkbox"/> Lymphoma Panel (including the following) | <input type="checkbox"/> CLL Panel (6q-,11q-,13/13q-,17p-,+12)   |
| <input type="checkbox"/> Pediatric Pre-B ALL Panel (COG)                   | <input type="checkbox"/> t(14;18) (BCL2/IGH)                      | <input type="checkbox"/> CHIC2 deletion (FIP1L1-PDGFR $\alpha$ ) |
| <input type="checkbox"/> MLL involvement (11q23)                           | <input type="checkbox"/> t(11;14) (CCND1/IGH)                     |  |
| <input type="checkbox"/> t(12;21) (Pediatric ALL, TEL/AML1)                | <input type="checkbox"/> t(8;14) (c-MYC/IGH)                      | <input type="checkbox"/> Other _____                             |

### Molecular: (Requires Purple Top tube--EDTA)

- |   |   |  |
|---|---|--|
| <input type="checkbox"/> Factor V Leiden (ICD9=286.3) | <input type="checkbox"/> Factor V HR2 (done if Leiden positive) | <input type="checkbox"/> Quantitative PCR for PML/RARA |
| <input type="checkbox"/> Prothrombin (ICD9=286.3)     | <input type="checkbox"/> Hereditary Hemochromatosis             | <input type="checkbox"/> Quantitative PCR for BCR/ABL  |
| <input type="checkbox"/> MTHFR (ICD9=286.3)           | <input type="checkbox"/> NPM1 Mutation Analysis                 | <input type="checkbox"/> JAK2 Mutation Analysis        |
| <input type="checkbox"/> T-Cell Gene Rearrangements   | <input type="checkbox"/> DNA Extract and Store                  | <input type="checkbox"/> FLT3 Analysis                 |
|   |   | <input type="checkbox"/> Other _____                   |

### Pre-Transplant:

### -- CHIMERISM STUDY --

### Post-Transplant:

- |  |  |
|--|--|
| <input type="checkbox"/> Donor (Requires Purple Top tube—EDTA)                   | <input type="checkbox"/> FISH (X/Y Sex Chromosomes) (Requires <b>Green</b> Top tube--NaHep)    |
| <input type="checkbox"/> Recipient <b>Blood</b> (Requires Purple Top tube--EDTA) | <b>OR</b> –  |
| <input type="checkbox"/> Recipient <b>Buccal Swab</b>                            | <input type="checkbox"/> DNA (Microsatellite Analysis) (Requires <b>Purple</b> Top tube--EDTA) |

PRENATAL TESTING REQUISITION

[www.chglab.com](http://www.chglab.com)

**SPECIMEN INFORMATION**

\*Collection date \_\_\_\_\_ Institution \_\_\_\_\_ Time of Collection \_\_\_\_\_  
 Amniotic Fluid \_\_\_\_cc's (1<sup>st</sup> cc's separated Y/N)  CVS  Cord Blood  Products of Conception (specify) \_\_\_\_\_  
 Peripheral Blood  Tissue (specify) \_\_\_\_\_  Other \_\_\_\_\_

**PATIENT INFORMATION**

Name (Last, First): \_\_\_\_\_  
DOB: \_\_\_\_/\_\_\_\_/\_\_\_\_ Medical Record Number: \_\_\_\_\_  
Address: \_\_\_\_\_ Phone: \_\_\_\_\_  
City, State, Zip: \_\_\_\_\_ SS #: \_\_\_\_/\_\_\_\_/\_\_\_\_  
Pregnant: Yes / No Gestational age: \_\_\_\_\_ Gender by U/S: Male / Female / Unknown Twins? Y/N  
Ethnicity:  Caucasian ( NW European  SW European )  Ashkenazi Jewish  Other Jewish  Hispanic  Asian  Afr. American  
 Native American  Other: \_\_\_\_\_

**REFERRING PHYSICIAN**

Name \_\_\_\_\_ Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
Name & Phone of person completing requisition: \_\_\_\_\_  Informed consent obtained (if appropriate)

**BILLING INFORMATION**

Bill:  Insurance  Referring Institution  Patient  Other Party

\* If Insurance will be billed, please attach a copy of current insurance card (front and back), which should include:  
Patient Name, Insurance Provider address & phone #, Policy #, Group #, Relationship to Patient

**TEST INDICATION**

ICD9 CODES (Required): \_\_\_\_\_

**Cyto/Molecular Tests**

-- CYTOGENETICS

- CHROMOSOME ANALYSIS/KARYOTYPE  
(Amniotic Fluid AFP done automatically unless otherwise specified)  No AFP
- Aneuvysion FISH (prenatal screen for X, Y, 13, 18, 21)
- FISH with Selected Probe (Specify) \_\_\_\_\_
- Save Cells Temporarily (Reason) \_\_\_\_\_

-- MOLECULAR (purple top EDTA required)

- Uniparental Disomy, Chrom # \_\_\_\_\_ (purple top tube)
- Thrombophilia Panel (purple top tube)
  - Factor V Leiden Mutation with reflex HR2
  - Prothrombin Mutation Analysis
  - MTHFR C677T Mutation Analysis
- Other \_\_\_\_\_

-- Additional tests on Amnio/CVS to be sent out:

- CF  CMV  Toxoplasmosis  Parvovirus
- Herpes I/II  RhD genotyping  Sickle Cell

**Ethnicity-Based Screening**

(5mL in purple top EDTA Tube)

- Cystic Fibrosis Carrier Screen (41 Mutations)
- Ashkenazi Jewish Panel (CF NOT included)
  - Bloom syndrome
  - Canavan Disease
  - Familial Dysautonomia
  - Tay-Sachs
  - Fanconi Anemia Type C
  - Gaucher Disease Type 1
  - Mucopolidosis Type IV
  - Niemann-Pick Type A & B

**Complete Required Information:**

\_\_\_\_ Patient/Couple is Pregnant  
\_\_\_\_ Family history of Disorder and/or Mutation  
**Specify** \_\_\_\_\_  
\_\_\_\_ Abnormal Ultrasound \_\_\_\_\_  
\_\_\_\_ Absence of Vas Deferens  
\_\_\_\_ Other Infertility

**Maternal Serum Screening**

(Red or Yellow Gel Separator Tube Required)

- Quad Check (AFP/UE3/hCG/Inhibin A)
  - Triple Check (AFP/UE3/hCG)
  - AFP Only
  - Repeat Test at This Laboratory
- Complete Required Information:**  
Patient Current Weight \_\_\_\_\_  
Insulin-Dependent Diabetic: \_\_\_\_ Yes \_\_\_\_ No  
Twin Pregnancy: \_\_\_\_ Yes \_\_\_\_ No \_\_\_\_ Unknown  
Previous Child with ONTD: \_\_\_\_ Yes \_\_\_\_ No  
Family History of ONTD: \_\_\_\_ Yes \_\_\_\_ No

**Gestational Age Dating:**

Last Menstrual Period \_\_\_\_\_  
Date of Ultrasound \_\_\_\_\_  
Gestational Age on that date \_\_\_\_\_  
EDC (By US Dating Only) \_\_\_\_\_  
By Physical Exam: \_\_\_\_\_ weeks  
Date of Exam \_\_\_\_\_

**UroVysion™ FISH Testing Requisition**

[www.chglab.com](http://www.chglab.com)

**SPECIMEN INFORMATION**

Urine     Other (specify) \_\_\_\_\_    Date of collection \_\_\_\_\_

**PATIENT IDENTIFICATION**

PATIENT NAME \_\_\_\_\_ SEX    Male Female (circle one)

DATE OF BIRTH \_\_\_\_\_ ADDRESS #1 \_\_\_\_\_

SOCIAL SECURITY # \_\_\_\_\_ ADDRESS #2 \_\_\_\_\_

MEDICAL RECORD NUMBER \_\_\_\_\_ PHONE \_\_\_\_\_

**REASON FOR REFERRAL**

\_\_\_\_\_ HEMATURIA (ICD9 599.70)    \_\_\_\_\_ OTHER (SPECIFY)

\_\_\_\_\_ BLADDER CANCER (ICD9 188.9, 239.4) Diagnostic or recurrence? (circle one)

**REFERRING PHYSICIAN**

Name \_\_\_\_\_ Phone \_\_\_\_\_ Fax \_\_\_\_\_

Address \_\_\_\_\_

Results also sent to: \_\_\_\_\_

**REFERRING INSTITUTION**

Name \_\_\_\_\_

**BILLING INFORMATION**

- Bill:**  Referring Institution  
 Patient Directly  
 Patient Insurance (Please attach insurance information)