UNIVERSITY OF PITTSBURGH MEDICAL CENTER
DEPARTMENT OF PATHOLOGY

Molecular Anatomic Pathology Laboratory Tests

Test ID	Test Description	LOH Loci Tested	Genes/Mutation Tested	Sample Sources	Turn-Around-Time*
Glioma Panel (IGLIOMA)	**Detection of LOH in gliomas.** Normal and tumor tissue specimen microdissection, nucleic acids isolation, PCR amplification followed by capillary gel electrophoresis.	1p36 19q13 CDKN2A/B (p16) PTEN TP53		Paraffin-embedded tissue, blood, buccal swabs	
MSI Panel	**Detection of microsatellite instability in colon cancer, endometrial carcinomas.** Normal and tumor tissue specimen microdissection, nucleic acids isolation, PCR amplification followed by capillary gel electrophoresis.	D5S123 D5S346 D17S250 BAT25 BAT26 Extra 5 loci tested if MSI-L		Paraffin-embedded tissue, frozen tissue	
Pancreatic Panel	**Detection of LOH and KRAS 12/13 mutation in pancreatic masses and pancreatic cysts.** Normal and tumor tissue specimen microdissection, nucleic acids isolation, PCR amplification followed by capillary gel electrophoresis or nucleotide sequencing.	CMM/RIZ VHL APC CDKN2A PTEN TP53 PTCH Her2/neu ETS2 NF2 MEN1	KRAS exon 1, codon 12/13	Paraffin-embedded tissue, frozen tissue, blood, buccal swabs, pancreatic cyst fluid	
AdenoLung Panel	**Detection of EGFR exons 19 and 21 mutations and KRAS exon 1, codons 12/13 mutations in adenocarcinomas of lung** Normal and tumor tissue specimens microdissection, nucleic acids isolation, PCR amplification followed by nucleotide sequencing		EGFR Exon19 EGFR Exon21 KRAS exon 1, codon 12/13	Paraffin-embedded tissue and frozen tissue	
Tissue Identity Test	**Identification of switched, mislabeled specimens or tissue contaminants in surgical pathology specimens.** **Diagnosis of molar pregnancy.** Tissue specimens microdissection, nucleic acids isolation, PCR amplification of short tandem repeats (STRs) followed by capillary gel electrophoresis.	15 chromosomal loci (including X,Y)		Paraffin-embedded tissue and frozen tissue, Blood, buccal swabs, amniotic fluid, chorionic villi	

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Parathyroid Panel	**Detection of LOH in parathyroid tumors.** Normal and tumor tissue specimen microdissection, nucleic acids isolation, PCR amplification followed by capillary gel electrophoresis.	1q 1p36.21 VHL APC 6q27 MET p16 PTEN KAI1 11p11.2 HRAS 11p15.5 RB 13q14.3 NM-23 17q21 TP53 17p13.1 NF2 22q12.2		Paraffin-embedded tissue and frozen tissue.	
Double Primary Tumor Tests	**Establishing if two tumors are double primary or tumor and metastasis using LOH analysis.** Tumor tissue specimen microdissection, nucleic acids isolation, PCR amplification followed by capillary gel electrophoresis.	20 microsatellite markers are tested		Paraffin-embedded tissue and frozen tissue.	
Liver Panel	**Detection of LOH in liver masses.** Normal and tumor tissue specimen microdissection, nucleic acids isolation, PCR amplification followed by capillary gel electrophoresis or nucleotide sequencing	CMM/RIZ 1p36 APC CDKN2A TP53 OGG1 DCC		Paraffin-embedded tissue, frozen tissue, blood, buccal swabs, pancreatic cyst fluid	
VHL	**Detection of the VHL gene loss in renal cell carcinomas (RCCs)**	3p25-26 (VHL)		Paraffin-embedded tissue, frozen tissue	
Thyroid Panel	**Detection of tumor-specific mutations in thyroid nodules in FNA and surgical samples** Nucleic acid isolation, real time PCR or RT-PCR amplification, melting curve analysis		KRAS NRAS BRAF HRAS RET/PTC1 RET/PTC3 PAX8/PPARg	Thyroid FNA specimens, Paraffin-embedded tissue, frozen tissue	
BRAF	**Detection of BRAF mutation in tumors** Tissue specimen microdissection, nucleic acids isolation, PCR amplification followed by nucleotide sequencing or real-time PCR		BRAF V600E		
KRAS 12/13	**Detection of KRAS codons12/13 mutation in tumors** Tissue specimen microdissection, nucleic acids isolation, PCR amplification followed by nucleotide sequencing or real-time PCR		KRAS exon 1, codons 12/13		

Tests in development

1. **MGMT promoter methylation in gliomas and colon cancer.**
2. **Real-time PCR detection of translocations found in pediatric and adult sarcomas (Synovial, Ewings etc).**
3. **Rearrangements in endometrial stromal sarcoma (i.e. JJAZ-JAZF1, etc.).**
4. **LOH panel for appendicial cancer.**
5. **Test for tumors of unknown origin based on gene expression profiling.**
6. **miRNA based test for thyroid FNA samples.**

FISH Tests

Oncology

1. 1p deletion testing for glioma
2. 19q deletion testing for glioma
3. UroVysion test for bladder cancer
4. p16 gene located at 9p21
5. RET gene rearrangement testing by FISH
6. Cyclin D1 break-apart probe
7. 11q13 Cyclin D1 with CEP11
8. 7q31
9. c-myc gene
10. EGFR gene by FISH
11. Ewing Sarcoma translocation region by FISH 22q12
12. HER2/neu by FISH Pathvysion 17q11.2-q12
13. Centromere 8 ploidy
14. Synovial sarcoma testing for the SYT translocation 18q11.2
15. XY testing by FISH dual-color
16. Kidney panel for Centromere 1,2,7,17
17. CHOP Probe for myxoid/round cell liposarcoma
18. p53 by FISH
19. Prostate testing for HER2/neu, c-myc, 7q31 (FISH)
20. RB1 testing by FISH
21. FKHR FISH probe for alveolar rhabdomyosarcoma
22. FUS gene probe 16p11
23. 1p and 19q testing by FISH and PCR
24. iBREAST: TOP2A/HER2/CEP17

Insitu (Brightfield) Infectious diseases

1. Adenovirus
2. BK Virus
3. CMV
4. EBER probe for EBV mRNA iHPV
5. HPV probe panel
6. HPV 16,18,31,33,35,39,45,51,52,56,58,66 subtype (high)(Ventana)
7. HPV 6+11 subtype (low) (Ventana)
8. HSV probe
9. JC virus probe
10. mRNA for Lambda light chain restriction
11. mRNA for Kappa chain restriction

Infectious disease testing

1. Adenovirus, qualitative realtime PCR
2. Bacterial strain identification (rRNA gene sequence analysis)
3. BK (Polyoma) virus, quantitative PCR
4. Cytomegalovirus (CMV), qualitative realtime PCR
5. Epstein-Barr Virus (EBV), qualitative realtime PCR
6. EBV (Epstein-Barr Virus) Clonality Studies, Southern blot
7. Hepatitis B Virus, PCR (This test is quantitative in plasma samples and qualitative in liver biopsy samples)
8. Hepatitis C Virus, RT-PCR (This test is quantitative in plasma samples and qualitative in liver biopsy samples)
9. Hepatitis C genotype, via Invader^^
10. Hepatitis C genotype, DNA sequence analysis
11. Herpes Simplex Virus (HSV), Types 1 and 2, qualitative realtime PCR
12. Herpes Simplex Virus (HSV), Type 1
13. Herpes Simplex Virus (HSV), Type 2

14. HIV-I, Quantitative RT-PCR (Viral Load) ultrasensitive (use purple-top EDTA tube)
15. Human T-cell Leukemia Virus - Type I (HTLV-I), qualitative realtime PCR
16. Human T-cell Leukemia Virus - Type II (HTLV-II), qualitative realtime PCR
17. JC (Polyoma) virus, qualitative realtime PCR
18. Varicella Zoster Virus (VZV), qualitative realtime PCR

Oncology Testing

1. DNA and/or RNA Isolation and Storage
2. Molecular Diagnostic consultation – will order appropriate studies after reviewing histopathologic and other information. Nucleic acid will be stored for potential future testing if molecular testing is not indicated.
3. CLL sequencing analysis for mutated/non-mutated IgH status
4. EBV Clonality Study (Terminal Repeat Analysis), Southern Blot
5. Immunoglobulin heavy chain gene rearrangement studies
6. PCR Southern Blot
7. JAK2 V617F Mutation testing (PCR) – myeloproliferative disorders
8. t(3;others), *BCL6*;others, Southern blot
9. t(8;others), *c-MYC*;others, Southern blot
10. t(9;22), *BCR-ABL*, quantitative RT-PCR
11. t(14;18), *BCL2-IGH* translocation studies (all studies will be performed unless individually checked)
12. *BCL2-IGH,* Major breakpoint region (Mbr), PCR
13. *BCL2-IGH,* Minor cluster region (mcr), PCR
14. *BCL2-IGH,* Mbr and mcr, Southern blot
15. t(15;17), *PML-RARA* translocation, RT-PCR
16. T-cell receptor gene rearrangement studies
17. Gamma chain (PCR) Beta chain (Southern blot)

Genetic Testing

1. *BRCA1* and *BRCA2*, Ashkenazi Jewish Screening Panel only
2. Cystic Fibrosis (ACMG 23 Mutation panel) with poly-T analysis
3. Factor II (Prothrombin 20210G>A) Analysis
4. Factor V Leiden
5. Fragile X Syndrome
6. Hemochromatosis (C282Y and H63D variants)
7. Hereditary Pancreatic carcinoma, Palladin (PALLD) gene sequencing)
8. Hereditary Pancreatitis (R122H, N29I, A16V and other mutations)
9. Hereditary Paraganglioma (Can order each gene separately – see below)
10. *SDHD SDHB SDHC* (Method: Sequencing)
11. Huntington Disease (Informed consent required for presymptomatic testing)
12. Isovaleric Acidemia (Isovaleryl-CoA-Dehydrogenase gene sequencing
13. Lymphedema Distichiasis Syndrome (FOXC2 gene sequencing)**
14. Malignant Hyperthermia (RYR1 gene sequence analysis)
15. MCAD Deficiency (Medium Chain Acyl CoA Dehydrogenase), exon 11 –detects common and other mutations (>90% of all described).
16. Multiple Endocrine Neoplasia, MEN 2A and 2B (c-*RET* oncogene sequencing)
17. Mitochondrial Mutation Panel (Can order each group separately)
18. MELAS MERRF NARP
19. MTHFR, 677C>T Thermolabile Polymorphism
20. Spinal Muscular Atrophy, autosomal recessive (types I, II, III)
21. *SPINK1* (Serine protease inhibitor Kazal type 1)
22. UGT1A1 polymorphism analysis (for Gilbert's syndrome and irinotecan therapy)