Cleveland Clinic

# Cleveland Clinic Laboratories

## Anatomic Pathology Special Stains

### Group I for Microorganisms

| Special Stains Group I 88312 | Primary Demonstration of: |
|---|---|
| Fite stain | Stains for *mycobacteria leprae* |
| Gomori's methenamine silver (GMS) | Fungus, Pneumocystis, Bacteria |
| Gram | Gram-positive and gram-negative bacteria |
| Gridley | Fungus |
| Steiner | Spirochetes, Bacteria |
| PAS/light green counterstain | Fungus |
| Warthin-Starry | Bacteria, Spirochetes |
| Ziehl-Neelsen AFB | Acid-fast mycobacterium |

### Group II (All Other)

| Special Stains Group II 88313 | Primary Demonstration of: |
|---|---|
| Alcian Blue, pH 2.5 | Acid mucopolysaccharides |
| Alcian Blue/Hyaluronidase | Differentiation of epithelial and connective tissue mucins |
| Alcian Blue/PAS | Acid and neutral mucins |
| Aldehyde fuchsin | Copper-binding protein, Elastic fibers |
| ASD 'Leder's modification' | Esterase, Mast cells |
| Bielschowsky | Neurofibrils |
| Bile, Hall's method | Bilirubin |
| Bodian | Nerve fibers |
| Colloidal iron | Mucopolysaccharides, Collagen |
| Colloidal Iron/Hyaluronidase | Differentiation of epithelial and connective tissue mucins |
| Congo Red | Amyloid |
| Copper (Rhodanine) | Copper |
| Crystal Violet | Amyloid |
| Elastic stain (EVG) | Elastic fibers, Collagen |
| Fontana-Masson | Argentaffin granules or Melanin |
| Giemsa (mast cell) | Eosinphilic granules and Mast cells |
| Grimelius | Argyrophil granules, Argentaffin |
| Iron stain | Iron |
| Jones methenamine silver | Basement membranes, Reticular fibers |
| Luxol fast blue | Myelin |
| Masson trichrome | Collagen |
| Melanin bleach | Eliminates melanin |
| Movat | Elastic fibers, Collagen, Mucin, Fibrin and Muscle |
| Mucicarmine | Mucosubstances |
| Oil Red O | Fat |
| Orcein | Copper-binding Protein, Elastic fibers |
| PAS/amylase (PAS/D) | Eliminates glycogen |
| Periodic acid-Schiff (PAS) | Glycogen, Neutral mucopolysaccharides and Basement membranes |
| PTAH | Collagen, Fibrin, Coarse elastic fibrils |
| Reticulum | Stains for reticulum fibers |
| SAB | Amyloid |
| Thioflavin S | Amyloid |

## Group II (All Other cont.)

| Special Stains Group II 88313 | Primary Demonstration of: |
|---|---|
| Toluidine Blue | Mast cell granules |
| Uric acid | Urate crystals |
| Von Kossa | Calcium |

| Histochemical Stains (Enzyme) 88319 | Primary Demonstration of: |
|---|---|
| Acetylcholinesterase (ACE) | Nerve fibers/Hirschsprung's disease |
| Acid phosphatase | Muscle fibers undergoing degeneration |
| Alkaline phosphatase | Basement membranes and regenerating fibers |
| ATP (4.6, 9.8) | Muscle fiber types |
| Cytochrome C | Cytochrome oxidase |
| Esterase | Denervated muscle fibers |
| NADH | Whorls, Target fibers, Central cores, Moth-eaten fibers |
| Phosphofructokinase | PFK activity |
| Phosphorylase | Phosphorylase activity |
| Succinic dehydrogenase (SDH) | Mitochondrial disease |

# Immunohistochemistry Stains

| Stain | Antibody Specificity |
|---|---|
| ACTH | Human adrenocorticotropic hormone |
| Actin HHF35 | Human muscle actin |
| Actin SM | Alpha-smooth muscle isoform, Myoepithelium, etc. |
| Adenovirus | Adenovirus |
| AFP | Alpha fetoprotein |
| ALK (D5F3) | Anaplastic lymphoma kinase, clone D5F3 |
| ALK-1 | ALK-1 |
| Amyloid A (AMY-A) | Amyloidosis |
| Amyloid Kappa (AMY-K) | Amyloidosis |
| Amyloid Lambda (AMY-L) | Amyloidosis |
| Androgen Recept | Androgen Receptor |
| Arginase 1 | Identify normal liver cells |
| ß-Catenin | Beta Catenin |
| BCL-2 | Follicular lymphoma, Apoptosis inhibin protein |
| BCL2 EP36 | BCL2, clone EP36 |
| BCL-6 | Follicular and diffuse lymphomas, Burkitt's lymphoma & Lymphocyte predominant Hodgkin's disease |
| B72.3 | Tumor associated glycoprotein |
| BOB-1 | Transcription coactivator for Oct-1 and Oct-2 |
| CA9 | Carbonic Anhydrase IX |
| CA 125 | Tumor marker for ovarian, endometrial, breast, GI cancer |
| Calcitonin (CALC) | Calcitonin |
| Calretinin (CALR) | Calcium-binding protein, Mesothelial cells |
| C3d | Complement 3d, transplant rejection biomarker |
| C4d | Complement 4d, transplant rejection biomarker |
| CD1a | Cortical thymocytes-langerhans cells |
| CD2 | Lymphocyte function-associated antigen 2 |
| CD3 (2VG6) | T-Cells |

| Stain | Antibody Specificity |
|---|---|
| CD4 | T-Cells, Helper T |
| CD5 | Pan T-cells, B-cell subset, Thymic carcinomas |
| CD7 | Thymocytes, Immature t-cells, NK cells |
| CD8 | T-Cells, Suppressor T |
| CD10 | Common acute lymphoblastic leukemia |
| CD15 | Epithelial/Hodgkin's/Myeloid |
| CD19 | B-Lymphocyte antigen |
| CD20 | Human B-lymphocyte antigen |
| CD21 | Dendritic cells, B-cells |
| CD22 | Mature B-cells |
| CD23 | Activated B-cells |
| CD25 | Activated T-cells and B-cells |
| CD30 | Ki-1: Activated T, B, RS cells |
| CD31 | Endothelium (tumor angiogenesis) |
| CD33 | Monocytes |
| CD34 | Endothelium, Stem cells, Stromal tumors |
| CD35 | Dendritic cells |
| CD43 | T-cells, B-cell subset, Myeloid, Histiocytes, Plasma cells (leukosialin) |
| CD44 | Phagocytic glycogen-1 |
| CD45 | Helper, Inducer T-cells |
| CD45RO | Helper, Inducer T-cells |
| CD56 | Natural killer cells |
| CD57 | Neural and neuroendocrine marker NK cells, Stromal tumors |
| CD61 | GP111A |
| CD68 (KP1) | Sarcomas and leukemia |
| CD68 (PG-M1) | Monocytes/Macrophages |
| CD71 | Erythroid precursor marker |
| CD79a | B-cells |
| CD99 | Ewing's sarcoma/PNET |
| CD117 | C-kit |
| CD123 | Alpha receptor for IL3 |
| CD138 | Plasma cell marker, Syndecan |
| CD163 | Ber-MAC3 |
| CDX-2 | Metastatic colon CA |
| CEA | Carcinoembryonic antigen |
| Chromogranin (CHROMO) | Chromogranin A |
| Clusterin | Apoptosis |
| Cox-2 | Inflammation |
| Cyclin-D1 | Cyclin D1/PRAD-1 oncogene product, Mantle cell |
| CMV | Cytomegalovirus |
| c-MYC | Lymphoma marker |
| CXCL-13 | B-Lymphocyte chemoattractant |
| D2-40 | Podoplanin, lymphatic endothelial marker |
| Desmin | Desmin |
| EBNA-2 | Stains nuclei of EBV-infected lymphoblastoid cells |
| DOG-1 | GIST marker |
| EBV | Epstein-Barr virus |
| E-cadherin (CADH) | Epithelial marker |
| EGFR | Epithelial growth-factor receptor |
| EMA | Epithelial membrane antigen |
| Enolase (NSE) | Neuron specific enolase |

| Stain | Antibody Specificity |
|---|---|
| EP4-Ber | Epithelial antigen |
| ERG | Vascular marker and prostate malignancy marker |
| ER | Estrogen receptor |
| Factor VIII | Von Willebrand factor, Endotheium and megakaryocytes |
| Factor XIII | Fibrohistiocytic tumors, Dendritic interstitial cells |
| Fascin | Hodgkin's disease, High grade breast carcinoma |
| FGFR3 | CD333, Fibroblast growth factor receptor 3 |
| FOXP1 | Prognosis of lymphoma, leukemia, carcinoma |
| FOX-P3 | T regulatory cell marker |
| FSH | Follicle stimulating hormone |
| Galectin | Inflammation and cancer |
| Gastrin | Gastrin secreting tumors, G-cell hyperplasia |
| GATA3 | Urothelial carcinoma marker |
| GCDFP-24 | Gross cystic disease fluid protein-15 |
| GCET1 | Germinal center B-cell marker |
| GFAP | Human glial fibrillary acidic protein |
| GH | Growth hormone |
| Glucagon | Glucagon |
| Glutamine Synthetase | Hepatocellular carcinoma marker |
| Glypican-3 | Hepatocellular carcinoma marker |
| Granzyme-B | Serine protease |
| Hemoglobin-A | Hemoglobin-A |
| HBcAg | Hepatitis B core antigen |
| HBsAg | Hepatitis B surface antigen |
| H-Caldesmon (HCAL) | Smooth muscle differentiation |
| H.pylori | Helicobacter pylori |
| ßHCG | HCG in trophoblastic elements of germ cell tumors |
| Hepatocyte | Hep-par1 |
| Herpes (HSVI&II) | HSV I/II |
| HER2 Neu (4B5) | Erb-2 oncoprotein, Clone 4B5 |
| HHV8 | Human herpesvirus 8 |
| HMB 45 | Melanoma associated marker |
| HPV | Human papilloma virus subtype |
| IDH-1 | Glioma Marker |
| IgA | Immunoglobulin A |
| IgD | Immunoglobulin D |
| IgG | Immunoglobulin G |
| IgG4 | Autoimmune pancreatitis |
| IgM | Immunoglobulin M |
| INI1 | Malignant rhabdoid tumor marker |
| Inhibin | Granulosa cell tumor, Sex cord stromal tumor |
| Insulin | Insulin |
| Ki67 | Cell proliferation marker |
| Kappa | Kappa light chain |
| Lambda | Lambda light chain |
| Langerin | Langerhans cell histiocytosis |
| LEF1 | Chronic lymphocytic (CLL)/small lymphocytic (SLL) leukemias |
| LH | Luteinizing hormone |
| LMO2 | Large B-cell lymphoma marker |
| Mammaglobin | Primary and metastatic breast carcinoma marker |
| MDM2 | Liposarcoma |

| Stain | Antibody Specificity |
|---|---|
| Melan A | Malignant melanoma marker |
| MiTF | Melanocyte development regulator, melanoma oncogene |
| MLH-1 | Mismatch repair gene MLH-1 |
| MOC-31 | Differentiate carcinomas from mesothelial cells and mesotheliomas |
| MSH-2 | Mismatch repair gene MSH-2 |
| MSH-6 | Mismatch repair gene MSH-6 |
| MUM-1 | Multiple myeloma oncogene-1 |
| Muramidase | Muramidase/Lysozyme |
| Myeloperoxidase | Neutrophilic granulocytes and monocytes |
| MyoD1 | Rhabdomyosarcoma marker |
| Myogenin | Rhabdomyosarcoma marker |
| Napsin A | Lung adenocarcinoma marker |
| Neurofilament | Neurofilament |
| Neurofilament Cocktail | Cocktail of clones 2F11 and SMI-32 |
| NKI/C3 | Melanoma marker |
| NKX3.1 | Differential marker for prostate carcinoma vs. urothelial carcinoma |
| OCT-2 | Octamer transcription factor 2 |
| OCT3/4 | Marker for undifferentiated cells |
| p16 | Cervical cancer marker |
| p40 | Pulmonary squamous cell carcinoma marker |
| P501s Protein | Confirm prostatic origin of metastatic carcinoma |
| p53 | Overexpression of the p53 oncogene |
| p57 | Differential diagnosis of complete vs partial hydatidiform molar pregnancy |
| p63 | Prostate cancer marker |
| p63/ERG Double Stain | A double stain for prostate cancer |
| PAP | Normal hyperplastic and neoplastic, Prostatic cells |
| PAX-2 | Tumor marker for kidney, prostate, breast, ovary |
| PAX-5 | B-cell specific activator protein |
| PAX-8 | Nephritic cell lineage marker |
| P-Component | Amyloidosis |
| Perforin | T-cell and NK cell lymphoma |
| PD1 | T-cell regulator |
| PDGFR | oligodendrocytic progenitor cells |
| PIN cocktail (p63&AMACR) | p63 and AMACR |
| Prolactin | Prolactin in pituitary |
| PLAP | Placental alkaline phosphatase, Germ cell and adenocarcinoma |
| PMS2 | Mismatch repair gene PMS-2 |
| PR | Progesterone receptor |
| PSA | Prostate specific antigen |
| PSMA | Prostate specific membrane antigen |
| PTEN | Differentiate breast, prostate carcinoma from normal |
| PTH | Parathyroid hormone |
| Racemase (AMACR) | Prostate adenocarcinoma marker |
| RCC | Renal Cell Carcinoma marker |
| S-100 | S100 protein |
| SALL4 | Yolk sac tumor marker |
| Serotonin | Carcinoid syndrome |
| SF-1 | Adrenocortical tumor marker |
| SMMS1 | Smooth muscle myosin |
| SOX-10 | Identify melanoma and nerve sheath tumors |
| SOX-11 | Mantle cell lymphoma marker |

| Stain | Antibody Specificity |
|---|---|
| pSTAT 5 | Surrogate marker of JAK2 V617F mutation |
| Synaptophysin | Synaptophysin |
| Syph | T. pallidum |
| Tau/Beta-amyloid DS | Neurofibrillary tangle and amyloid in Alzheimer's postmortem specimens |
| TCL-1A | Mature T-cell leukemia |
| TCR ß F1 | T-cells |
| TCR-Gamma | T-cells |
| TdT | Blasts, Immature lymphocytes |
| TFE-3 | Xp11 translocation renal cell carcinoma |
| Thyroglobulin | Thyroglobulin |
| TIA | Cytolytic effector cells in lymphocytic infiltrates |
| Transthyretin | Amyloidosis |
| Tryptase (MC trypt) | Human mast cells |
| TSH | Thyrotropic cells of pituitary |
| TTF-1 | Thyroid and pulmonary carcinomas |
| Tyrosinase | Metastatic melanoma |
| Ubiqutin | Neurofibrillary tangles of Alzheimer's disease |
| Vimentin | Vimentin |
| VS38C | Plasma cell |
| WT1 (6F-H2) | Wilms tumor |
| 14-3-3 | 14.3.3 Sigma, epithelial cell marker |
| **CISHs (+NEG & ALU or U6)** | |
| CISH EBER | Chromogenic *in situ* hybridization for EBV |
| CISH HPV | High risk chromogenic *in situ* hybridization for high risk HPV subtypes; low risk chromogenic *in situ* hybridization for low risk HPV subtypes |
| CISH Kappa | Chromogenic *in situ* hybridization for Kappa |
| CISH Lambda | Chromogenic *in situ* hybridization for Lambda |
| **KERATINS (App/T/Prost)** | |
| AE1/3 | Keratin cocktail: 40, 48, 50, 50, 6, 58, 65, 5 kD |
| CAM 5.2 | Keratin: 39, 43, 500 kD |
| CK 5/6 | Intermediate filament protein, Cytokeratin 5/6 |
| CK 7 | Keratin: 54 kD |
| CK 19 | Human cytokeratin 19 polypeptide |
| CK 20 | Keratin: 54 kD |
| KER 903 | High molecular weight cytokeratins |

**Cleveland Clinic**

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