

# Cleveland Clinic Laboratories

## **Anatomic Pathology Special Stains**

### **Group I for Microorganisms**

### Special Stains Group I 88312

Fite stain

Gomori's methenamine silver (GMS)

Gram Gridley Steiner

PAS/light green counterstain

Warthin-Starry Ziehl-Neelsen AFB

### Group II (All Other)

Acid-fast mycobacterium

Spirochetes, Bacteria

Bacteria, Spirochetes

**Primary Demonstration of:** 

Stains for mycobacteria leprae

Fungus, Pneumocystis, Bacteria

Gram-positive and gram-negative bacteria

**Primary Demonstration of:** Acid mucopolysaccharides

Differentiation of epithelial and connective tissue mucins

Acid and neutral mucins

Copper-binding protein, Elastic fibers

Esterase, Mast cells

Neurofibrils Bilirubin Nerve fibers

**Fungus** 

**Fungus** 

Mucopolysaccharides, Collagen

Differentiation of epithelial and connective tissue mucins

Amyloid Copper Amyloid

Elastic fibers, Collagen

Argentaffin granules or Melanin Eosinphilic granules and Mast cells Argyrophil granules, Argentaffin

Iron

Basement membranes, Reticular fibers

Myelin Collagen

Eliminates melanin

Elastic fibers, Collagen, Mucin, Fibrin and Muscle

Mucosubstances

Fat

Copper-binding Protein, Elastic fibers

Eliminates glycogen

Glycogen, Neutral mucopolysaccharides and Basement membranes

Collagen, Fibrin, Coarse elastic fibrils

Stains for reticulum fibers

Amyloid Amyloid

### Special Stains Group II 88313

Alcian Blue, pH 2.5 Alcian Blue/Hyaluronidase

Alcian Blue/PAS Aldehyde fuchsin

ASD 'Leder's modification'

Bielschowsky Bile, Hall's method

Bodian

Colloidal iron

Colloidal Iron/Hyaluronidase

Congo Red

Copper (Rhodanine) Crystal Violet Elastic stain (EVG) Fontana-Masson Giemsa (mast cell)

Grimelius Iron stain

Jones methenamine silver

Luxol fast blue Masson trichrome Melanin bleach

Movat Mucicarmine Oil Red O

Orcein

PAS/amylase (PAS/D)

Periodic acid-Schiff (PAS)

PTAH Reticulum SAB Thioflavin S



#### **Group II (All Other cont.)**

#### Special Stains Group II 88313

Toluidine Blue Uric acid Von Kossa

#### Histochemical Stains (Enzyme) 88319

Acetylcholinesterase (ACE) Acid phosphatase Alkaline phosphatase ATP (4.6, 9.8) Cytochrome C Esterase

NADH Phosphofructokinase Phosphorylase

Succinic dehydrogenase (SDH)

### **Primary Demonstration of:**

Mast cell granules Urate crystals Calcium

#### **Primary Demonstration of:**

Nerve fibers/Hirschsprung's disease Muscle fibers undergoing degeneration Basement membranes and regenerating fibers

Muscle fiber types Cytochrome oxidase Denervated muscle fibers

Whorls, Target fibers, Central cores, Moth-eaten fibers

PFK activity

Phosphorylase activity Mitochondrial disease

## Immunohistochemistry Stains

#### Stain Antibody Specificity

ACTH
Actin HHF35
Actin SM
Adenovirus
AFP

ALK (D5F3) ALK-1

Amyloid A (AMY-A) Amyloid Kappa (AMY-K) Amyloid Lambda (AMY-L)

Androgen Recept Arginase 1 B-Catenin BCL-2 BCL2 EP36 BCL-6

B72.3 B0B-1 BRAF CA9 CA 125

Calcitonin (CALC)
Calretinin (CALR)

C3d C4d CD1a CD2 CD3 (2VG6) Human adrenocorticotropic hormone

Human muscle actin

Alpha-smooth muscle isoform, Myoepithelium, etc.

Adenovirus
Alpha fetoprotein

Anaplastic lymphoma kinase, clone D5F3

ALK-1 Amyloidosis Amyloidosis Amyloidosis Androgen Receptor Identify normal liver cells

Beta Catenin

Follicular lymphoma, Apoptosis inhibin protein

BCL2, clone EP36

Follicular and diffuse lymphomas, Burkitt's lymphoma &

Lymphocyte predominant Hodgkin's disease

Tumor associated glycoprotein

Transcription coactivator for Oct-1 and Oct-2

Hairy cell Leukemia Carbonic Anhydrase IX

Tumor marker for ovarian, endometrial, breast, GI cancer

Calcitonin

Calcium-binding protein, Mesothelial cells Complement 3d, transplant rejection biomarker Complement 4d, transplant rejection biomarker

Cortical thymocytes-langerhans cells Lymphocyte function-associated antigen 2

T-Cells

CD4 CD5 Pan T-Cells, Helper T Pan T-Cells, B-cell subset, Thymic carcinomas Thymocytes, Immature t-cells, NK cells T-Cells, Suppressor T Common acute lymphoblastic leukemia Epithelia/Hodgkin/s/Myeloid Epithelia/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hodgkin/Hod	Stain	Antibody Specificity
CD7	CD4	T-Cells, Helper T
CD7	CD5	Pan T-cells, B-cell subset, Thymic carcinomas
CD10	CD7	
CD15 CD19 B-Iymphocyte antigen CD20 Human B-Iymphocyte antigen CD21 Dendritic cells, B-cells CD22 Mature B-cells CD23 Activated B-cells CD25 CD24 Activated T-cells and B-cells CD30 Ki-1: Activated T, B, RS cells CD31 Endothelium (tumor angiogenesis) CD31 Endothelium, Stem cells, Stromal tumors CD34 CD34 CD34 CD34 CD35 CD34 CD34 CD43 CD43 CD44 Phagocytic glycogen-1 CD45 CD43 T-cells, B-cell subset, Myeloid, Histiocytes, Plasma cells (leukosialin) CD44 Phagocytic glycogen-1 CD45 Helper, Inducer T-cells CD45 CD48RO Helper, Inducer T-cells CD56 CD57 Neural and neuroendocrine marker NK cells, Stromal tumors CD61 GP111A CD68 (RP1) Sarcomas and leukemia CD68 (RPG-M1) CD68 (RPG-M1) CD68 (RPG-M1) CD79 CD71 CPTytroid precursor marker CD79a B-cells CD99 Ewing's sarcoma/PNET CD17 C-kit CD123 Alpha receptor for IL3 CD138 CD149 CD29 CD40 CD40 CD50 CD50 CD50 CD50 CD50 CD50 CD50 CD5	CD8	T-Cells, Suppressor T
CD19		Common acute lymphoblastic leukemia
CD20 CD21 CD21 CD22 CD23 CD23 CD23 CD25 CD25 CD26 CD26 CD27 CD27 CD27 CD27 CD28 CD28 CD28 CD29 CD29 CD29 CD29 CD29 CD29 CD29 CD29	CD15	Epithelial/Hodgkin's/Myeloid
CD21         Dendritic cells, B-cells           CD22         Mature B-cells           CD25         Activated F-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           CD45R0         Helper, Inducer T-cells           CD56         Natural killer cells           CD57         Neural and neuroendocrine marker NK cells, Stromal tumors           CD61         GP111A           CD68 (RF1)         Sarcomas and leukemia           CD68 (RG-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           CNC-2	CD19	B-Lymphocyte antigen
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         Phagcoytic glycogen-1           CD45         Helper, Inducer T-cells           CD46         Helper, Inducer T-cells           CD47         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           CD17         C-kit           CD13         Alpha receptor for IL3           CD13         Alpha receptor for IL3           CD13	CD20	Human B-lymphocyte antigen
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c-MYC CXCL-13 B-Lymphoma marker  D2-40 Podoplanin, lymphatic endothelial marker  Desmin Desmin EBNA-2 Stains nuclei of EBV-infected lymphoblastoid cells  DOG-1 GIST marker  EBV E-cadherin (CADH) E-cadherin (CADH) EGFR EGFR Epithelial growth-factor receptor  EMA Epithelial membrane antigen		· · · · · · · · · · · · · · · · · · ·
CXCL-13  D2-40  Podoplanin, lymphatic endothelial marker  Desmin  EBNA-2  DOG-1  EBV  E-cadherin (CADH)  EGFR  EMA  B-Lymphocyte chemoattractant  Podoplanin, lymphatic endothelial marker  Desmin  Desmin  Stains nuclei of EBV-infected lymphoblastoid cells  GIST marker  Epstein-Barr virus  Epithelial marker  Epithelial growth-factor receptor  Epithelial membrane antigen		
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Desmin  EBNA-2  DOG-1  EBV  EBV  E-cadherin (CADH)  EGFR  EMA  Desmin  Stains nuclei of EBV-infected lymphoblastoid cells  GIST marker  Epstein-Barr virus  Epithelial marker  Epithelial growth-factor receptor  Epithelial membrane antigen		
EBNA-2  DOG-1  EBV  EBV  E-cadherin (CADH)  EGFR  EMA  Stains nuclei of EBV-infected lymphoblastoid cells  GIST marker  Epstein-Barr virus  Epithelial marker  Epithelial growth-factor receptor  Epithelial membrane antigen		· · · · · · · · · · · · · · · · · · ·
DOG-1  EBV  E-cadherin (CADH)  EGFR  EMA  GIST marker  Epstein-Barr virus  Epithelial marker  Epithelial growth-factor receptor  Epithelial membrane antigen		
EBV Epstein-Barr virus E-cadherin (CADH) Epithelial marker EGFR Epithelial growth-factor receptor EMA Epithelial membrane antigen		- · · · · · · · · · · · · · · · · · · ·
E-cadherin (CADH) Epithelial marker  EGFR Epithelial growth-factor receptor  EMA Epithelial membrane antigen		
EGFR Epithelial growth-factor receptor EMA Epithelial membrane antigen		·
EMA Epithelial membrane antigen		
Enolase (NSE)  Neuron specific enolase		
	Enoiase (NSE)	iveuron specific enoiase

#### 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

Fascin

FGFR3

FOXP1

Von Willebrand factor, Endotheium and megakaryocytes
Fibrohistiocytic tumors, Dendritic interstitial cells
Fibrohistiocytic tumors, Dendritic interstitial cells
Fibrohistiocytic tumors, Dendritic interstitial cells
Foxpassion

Foxpassion

Foxpassion

Von Willebrand factor, Endotheium and megakaryocytes
Fibrohistiocytic tumors, Dendritic interstitial cells
Foxpassion

Fox

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 Glutamine Synthetase Glucagon 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

BHCG in trophoblastic elements of germ cell tumors

Hepatocyte Hep-par1 Herpes (HSVI&II) HSV I/II

HER2 Neu (4B5)
HHV8
Human herpesvirus 8
HMB 45
Melanoma associated marker
HPV
Human papilloma virus subtype

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 Granulosa cen turnor, Sex cord stromai

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
MUC-4 Fibromyxoid sarcoma
MUM-1 Multiple myeloma oncogene-1

Muramidase Muramidase/Lysozyme

Myeloperoxidase Neutrophilic granulocytes and monocytes

MyoD1Rhabdomyosarcoma markerMyogeninRhabdomyosarcoma markerNapsin ALung 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 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

pSTAT 5 Synaptophysin

Syph

Tau/Beta-amyloid DS

TCL-1A TCR ß F1 TCR-Gamma

TdT TFE-3

Thyroglobulin

TIA

Transthyretin
Tryptase (MC trypt)

TSH TTF-1 Tyrosinase Ubiqutin Vimentin VS38C WT1 (6F-H2) 14-3-3

#### CISHs (+NEG & ALU or U6)

CISH EBER CISH Kappa CISH Lambda

#### **KERATINS (App/T/Prost)**

AE1/3 CAM 5.2 CK 5/6 CK 7 CK 19 CK 20 KER 903

#### **Antibody Specificity**

Surrogate marker of JAK2 V617F mutation

Synaptophysin T. pallidum

Neurofibrillary tangle and amyloid in Alzheimer's postmortem specimens

Mature T-cell leukemia

T-cells T-cells

Blasts, Immature lymphocytes

Xp11 translocation renal cell carcinoma

Thyroglobulin

Cytolytic effector cells in lymphocytic infiltrates

Amyloidosis Human mast cells

Thyrotropic cells of pituitary Thyroid and pulmonary carcinomas

Metastatic melanoma

Neurofibrillary tangles of Alzheimer's disease

Vimentin Plasma cell Wilms tumor

14.3.3 Sigma, epithelial cell marker

Chromogenic *in situ* hybridization for EBV Chromogenic *in situ* hybridization for Kappa Chromogenic *in situ* hybridization for Lambda

Keratin cocktail: 40, 48, 50, 50, 6, 58, 65, 5 kD

Keratin: 39, 43, 500 kD

Intermediate filament protein, Cytokeratin 5/6

Keratin: 54 kD

Human cytokeratin 19 polypeptide

Keratin: 54 kD

High molecular weight cytokeratins



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