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EP CLONES

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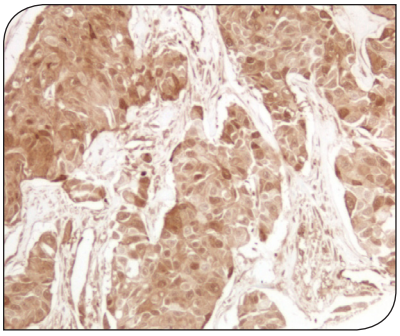
Catalog Supplement
vol. 2

*Distributed by Cell Marque™ Tissue & Cellular Diagnostics*



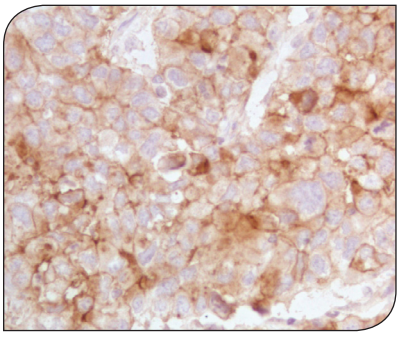
*Breast carcinoma stained with anti-human 4E-BP1*

## **4E-BP1** (EP352)

The eukaryotic translation initiation factor 4E-binding protein 1 (4E-BP1), also known as eIF4E-BP1, is a translation repressor inhibiting protein synthesis that sequester the mRNA cap-binding protein eIF4E. The Akt/mTOR/4E-BP1 pathway is considered to be a central regulator of protein synthesis.

This protein is phosphorylated in response to various signals including UV irradiation and insulin signaling, resulting in its dissociation from eIF4E and activation of mRNA translation. Over expression of total and phosphorylated 4E-BP1 has been associated with tumor progression in carcinomas of the breast, ovary, prostate and liver.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0325RUO<br>1 ml . . . . #AC-0325RUOC | colon, colon carcinoma | nuclear, cytoplasmic |



*Gastric carcinoma stained with anti-human 5T4*

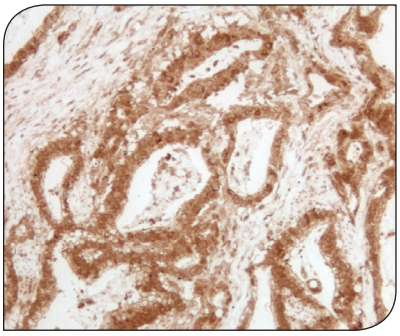
## **5T4** (EP347)

5T4 oncofetal antigen, also known as trophoblast glycoprotein (TPBG) is a 72-kDa membrane glycoprotein. While its specific function is unknown, 5T4 expression has been shown to influence adhesion, cytoskeletal organization and cell motility. Placental syncytiotrophoblasts highly express the 5T4 antigen.

In contrast, 5T4 expression has been reported in approximately 85% of colorectal and 81% of gastric carcinomas; expression in carcinomas of the bronchus, breast, cervix, endometrium, pancreas and ovary have also been reported. Presence of 5T4 in malignant cells is associated with advanced disease and poorer overall survival. Recent studies have shown that the 5T4 antigen is expressed on proliferating tumor-initiating cells (cancer stem cells) and associated with the epithelial-mesenchymal transition.

Due to its restricted expression and association with worse clinical outcome, 5T4 is a viable therapeutic target. Several vaccines, antibody-targeted immunotherapies and antibody-drug conjugates against 5T4 are currently under development.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0299RUO<br>1 ml . . . . #AC-0299RUOC | placenta, colon or gastric carcinoma | membranous |

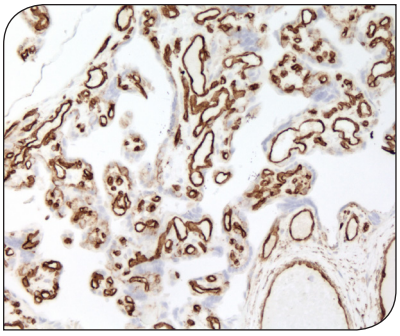


*Gastric carcinoma stained with anti-human Annexin VII*

## **Annexin VII** (EP367)

Annexin VII, also known as Annexin A7, is a calcium/phospholipid-binding protein belongs to the annexin superfamily. Annexin VII is broadly expressed in normal and tumor cells. Dysregulation of Annexin VII has been linked to progression of several types of tumors. The role of Annexin VII expression in tumor progression is tumor-type-specific. It acts as a tumor suppressor in glioblastoma, melanoma and prostate carcinoma, whereas high expression of Annexin VII may be associated with poor prognosis of hepatocellular carcinoma and gastric carcinoma.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0322RUO<br>1 ml . . . . #AC-0322RUOC | tonsil, prostatic carcinoma | cytoplasmic, membranous, nuclear |



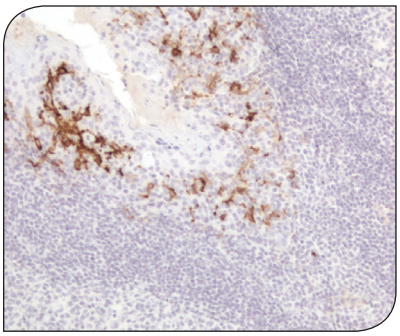
*Placenta stained with anti-Caveolin-1*

## **Caveolin-1** (EP353)

Caveolin-1, an integral plasma membrane protein located on human chromosome 7q31.1, is a member of the highly conserved 20-25kd Caveolin family that are the principal protein components of caveolae. Caveolae are flask-shaped invaginations of the plasma membrane that regulate molecular processes such as signal transduction and cell adhesion. It is expressed in terminally differentiated mesenchymal cells, including fibroblasts, adipocytes, endothelial cells, smooth and striated muscle cells, type I pneumocytes and epithelial cells.

Caveolin-1 was suggested as a useful marker for differentiating epithelioid mesothelioma from lung adenocarcinoma. While antibodies such as Calretinin, D2-40, Wilms' tumor-1 (WT1), thrombomodulin and mesothelin are well-known markers for mesothelioma, the utility of these antibodies are limited due to their low specificity. Caveolin-1 demonstrated 100% sensitivity and 92.5% specificity in differentiating epithelioid mesothelioma from lung adenocarcinoma. Inclusion of Caveolin-1 into an immunohistochemical panel may aid in the differential diagnosis of epithelioid mesothelioma.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0320A<br>1 ml . . . . . #AC-0320 | placenta, mesothelioma | membranous, cytoplasmic |



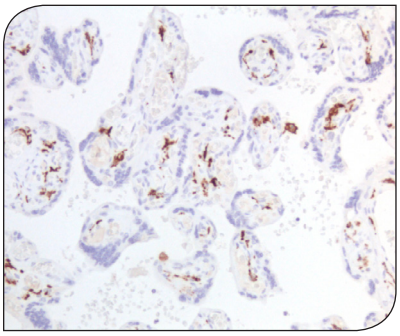
*Tonsil stained with anti-human CD16*

## **CD16** (EP364)

CD16 (FcγRIII) is a low affinity Fc receptor that binds to IgG antibodies. Two forms of the receptor, CD16A (FcγRIIIa) and CD16B (FcγRIIIb) are present in natural killer cells, neutrophils, monocytes and activated macrophages. Antibody-dependent cell-mediated cytotoxicity (ADCC), cytokine release and microbe killing can be induced upon binding with CD16.

Sconocchia, *et al.* demonstrated in a recent study that colorectal carcinoma patients with high CD16+ cell infiltration was associated with improved overall survival after adjusting for known prognostic factors and this association was independent from CD8+ lymphocyte infiltration and presence of metastases.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0332A<br>1 ml . . . . . #AC-0332 | tonsil | membranous |



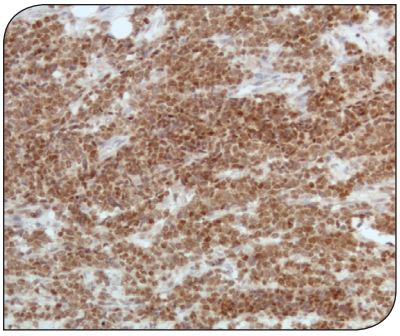
*Placenta stained with anti-CD163*

## **CD163** (EP324)

CD163 is an acute phase-regulated receptor involved in the clearance and endocytosis of hemoglobin/haptoglobin complexes by macrophages, thereby protecting tissues from free hemoglobin-mediated oxidative damage. Expression of CD163 is restricted to cells of the monocyte/macrophage lineage.

This antibody labels monocytes and macrophages in the spleen and peripheral blood. The CD163 antibody might be used for identifying tumors of monocytic origin.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0316A<br>1 ml . . . . . #AC-0316 | spleen | cytoplasmic, membranous |



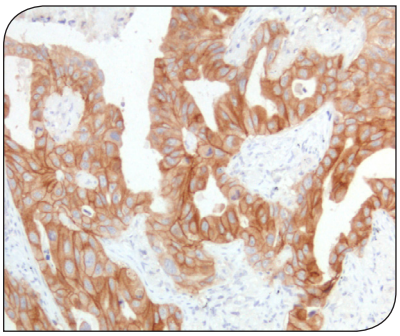
*Ewing's sarcoma stained with anti-human DAX1*

## **DAX-1 (NR0B1)** (EP358)

Nuclear receptor DAX-1, encoded by the gene *NR0B1*, is a member of the orphan nuclear receptor family that functions as a global negative regulator of steroid hormone production. DAX-1 negatively regulates steroid production as a transcriptional repressor or corepressor by repressing the expression of steroidogenic acute regulatory protein (STAR) in the adrenal cortex and gonads. DAX-1 expression is restricted to steroidogenic tissues such as the adrenal cortex, ovary, testis and other endocrine tissues.

In human neoplasms, DAX-1 has been examined in several types of tumors. Studies have demonstrated DAX-1 expression in adrenocortical, breast, and ovarian carcinomas. In operable node-negative breast cancer, high DAX-1 expression was correlated with increased survival. However, DAX-1 immunoreactivity was associated with poor prognosis in ovarian carcinoma. Also, the *NR0B1* gene was found to be necessary for oncogenic transformation of Ewing's sarcoma, it is highly expressed in Ewing's sarcoma but not in other histologically similar small round cell tumors such as neuroblastoma and embryonal rhabdomyosarcoma.

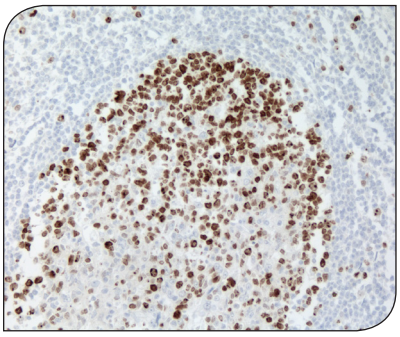
| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0330RUO<br>1 ml . . . . #AC-0330RUOC | ovary, Ewing's sarcoma | nuclear, cytoplasmic |



## **EGFR L858R** (EP344)

Analyte Specific Reagent: Analytical and performance characteristics are not determined.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0317A<br>1 ml . . . . . #AC-0317 | N/A | membranous, cytoplasmic |



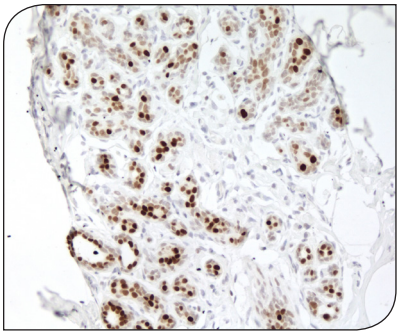
*Tonsil stained with anti-FOXM1*

## **FOXM1** (EP372)

Forkhead box protein M1 (FOXM1) is a major oncogenic transcription factor responsible for regulating genes involved in $G_1$-S and $G_2$-M cell cycle transitions into DNA replication and mitosis, respectively. FOXM1 is broadly distributed during embryonic development, but restricted to progenitor and proliferating cells in mature tissues.

FOXM1 has been implicated in tumorigenesis, facilitating tumor proliferation, angiogenesis and migration. Genome wide microarray studies consistently demonstrated *FOXM1* upregulation in many solid malignancies. FOXM1 overexpression is associated with chemotherapeutic resistance and poorer patient prognosis. Recent studies revealed close correlation between FOXM1 expression and HER2 status in breast cancers.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0323RUO<br>1 ml . . . . #AC-0323RUOC | colon, breast carcinoma | nuclear |



*Breast stained with anti-GATA3*

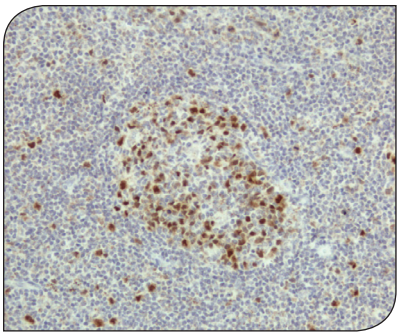
## **GATA3** (EP368)

GATA binding protein 3 (GATA3) is a zinc finger transcription factor that regulates the development in a variety of tissues and cell types. It has been detected in trophoblasts, epidermis, mammary and salivary glands, urothelia, distal nephron and subsets of T-lymphocytes.

GATA3 has been widely investigated as a marker for breast and urothelial carcinomas. GATA3 expression was detected in the majority of primary (90%) and metastatic (87%) mammary carcinomas. Positivity in triple-negative tumors is reported lower (43-67%). GATA3 is also considered a sensitive marker in the differential diagnosis of urothelial carcinoma from prostate adenocarcinoma, labeling the majority of urothelial carcinomas (86%) and none of prostate adenocarcinoma. It also demonstrates superior sensitivity compared to other urothelial markers: Thrombomodulin and Uroplakin III.

In a large scale analysis of 2,500 tumors, GATA3 was also detected in various epithelial and mesenchymal tumors. This marker is a sensitive but not completely specific for mammary and urothelial carcinomas.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0324A<br>1 ml . . . . . #AC-0324 | breast, breast carcinoma | nuclear |



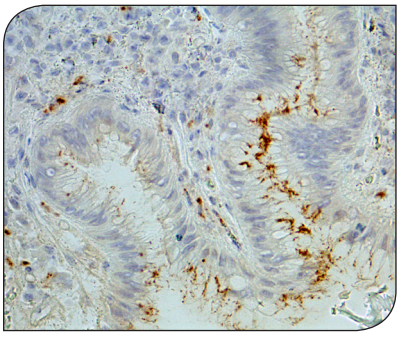
*Tonsil stained with anti-human Geminin*

## **Geminin** (EP355)

Geminin is a regulator of DNA replication. It interacts with the DNA replication initiation factor Cdt1p to inhibit the initiation of DNA replication. Geminin is absent during G1 phase, accumulates during S, G2, and M phases, and disappears at the metaphase–anaphase transition.

Geminin is expressed in proliferating cells. Over expression of Geminin has been found in tumors and the expression of Geminin in lymphomas and carcinomas of the breast, colon and stomach is correlated with cell proliferation as measured by Ki-67 staining.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0327A<br>1 ml . . . . . #AC-0327 | tonsil, breast carcinoma | nuclear, cytoplasmic |



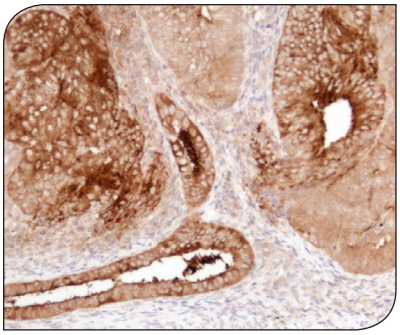
*H. Pylori infected stomach stained with anti-H. Pylori*

## **Helicobacter Pylori** (EP279)

Helicobacter Pylori (*H. Pylori*) is an endemic helix-shaped Gram-negative bacterium that infected over half of the world's population, reaching over 80% prevalence in developing countries. The bacterium attaches tightly to the gastric epithelia upon ingestion via unique bacterial-surface components and releases urease, permitting its survival in the acidic lumen. *H. Pylori* strains are highly diverse, and virulence is mediated by the secreted exotoxin VacA and cag pathogenicity island that induces host cellular apoptosis and inflammation.

*H. Pylori* colonization is a chronic condition without specific therapy, but asymptomatic in the majority of people. Infection with *H. Pylori* is responsible for the majority of duodenal and gastric ulcers, and have been associated with increased risk of developing mucosa-associate lymphoid tissue (MALT) lymphoma, atrophic gastritis and gastric cancer. Antibody to *H. pylori* is useful for detecting the bacterial infection in gastric and duodenal epithelial cells. Additionally, 0.5% to 6% of gastric infections are also attributed to a close species in the Helicobacter genus, *H. heilmannii*. Due to its low prevalence, a recent case study established the utility of an anti-*H. Pylori* antibody cross-reactivity in confirming *H. heilmannii* infection. Clone EP279 also demonstrates reactivity with the *H. heilmannii* bacterium.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0247A<br>1 ml . . . . . #AC-0247 | H. Pylori-infected tissue | bacterium |



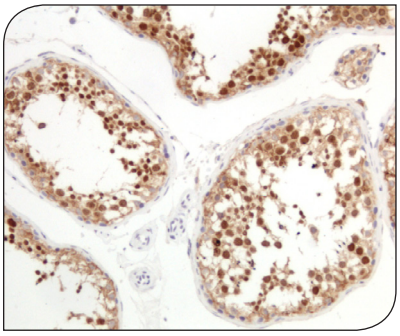
*Endometrial carcinoma stained with anti-human HE4*

## Human Epididymis Protein 4 (HE4) (EP370)

The Human Epididymis Protein 4 (HE4), also known as the WAP four-disulfide core domain protein 2 (WFDC2), is a 25 kDa secreted glycoprotein and is expressed in the epididymis, uterus, and tracheal tissues. HE4 was detected in bronchiolar, endocervical, endometrial, vas deferens, and breast epithelium by immunohistochemical staining. Distal convoluted tubules in the kidneys were also immunoreactive.

The value of serum HE4 as a biomarker for ovarian and endometrial cancers has been well recognized. Overexpression of HE4 enhanced the malignant behavior of cancer cells including proliferation, invasion, and colony formation. In 2003, HE4 was approved by the FDA as a serum tumor marker for ovarian cancer. A HE4 immunohistochemistry study demonstrated staining in all ovarian (36) and endometrioid (10) carcinomas. Recent studies have shown HE4 expression in other malignant tumors including lung adenocarcinoma, stomach cancer and pancreatic cancer.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0326A<br>1 ml . . . . . #AC-0326 | lung, ovarian carcinoma | cytoplasmic , nuclear |



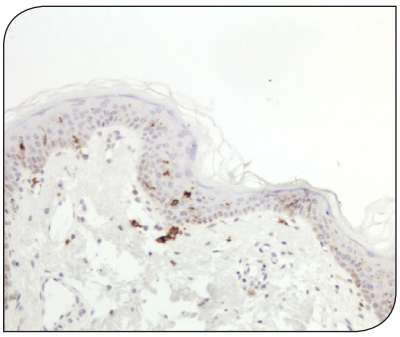
*Testis stained with anti-human Inhibin Alpha*

## Inhibin Alpha (EP378)

Inhibins are heterodimeric glycoproteins that selectively suppress the secretion of pituitary follicle stimulating hormone (FSH). Inhibins are predominantly secreted by granulosa cells of the ovary and Sertoli cells in the testis. Based on the current understanding of inhibin structure, an alpha subunit dimerizes with either a beta A or beta B subunit to form inhibin A and B, respectively. Inhibin Alpha is immunoreactive in follicular granulosa cells, theca interna, testicular Sertoli and Leydig cells, and luteinized stromal-thecal and hilar cells within the gonads, visually localized to the cytoplasm of target cells.

Inhibin Alpha is an established marker for ovarian sex cord stromal tumors and has been one of the commonly used markers in gynecologic pathology. The antibody stains the majority of tumor cells in granulosa cell tumors, Sertoli cell tumors, Sertoli-Leydig cell tumors, Leydig cell tumors, steroid cell tumors, sex cord tumors, and gynandroblastomas.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0315A<br>1 ml . . . . . #AC-0315 | ovary, oxarian sex cord stromal tumor | cytoplasmic |



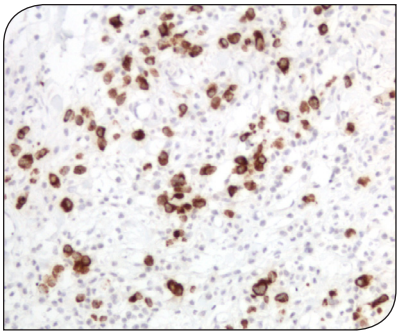
*Skin stained with anti-human Langerin (CD207)*

## Langerin (CD207) (EP349)

Langerin, also known as CD207, is a type II transmembrane receptor expressed on Langerhans cells. Langerhans cells are immature dendritic cells localized in the epidermis and mucosal epithelia that initiate innate and adaptive immune responses to skin-relevant antigens.

Tumors derived from Langerhans cells are classified into Langerhans cell histiocytosis (LCH) and Langerhans cell sarcoma (LCS). LCS is a rare dendritic cell tumor defined as a malignant high-grade variant of LCH. Differentiation between LCH, LCS and other tumors is difficult. The presence of Birbeck granules, CD1a and Langerin protein expression provides utility in differentiating Langerhans cell disorders from other non-Langerhans cell proliferations.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0328A<br>1 ml . . . . . #AC-0328 | skin, Langerhans cell histiocytosis | membranous |



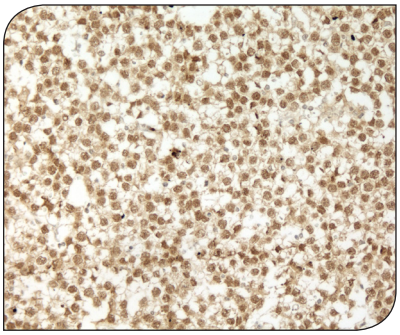
*Gastric carcinoma stained with anti-human MUC5AC*

## **MUC5AC** (EP362)

Mucins, the major components of mucus, are high molecular weight glycoproteins that covers the surfaces of epithelial tissues. The MUC5AC gene, located on chromosome 11p15.5 was initially cloned from tracheobronchial and stomach cDNA libraries. MUC5AC is primarily expressed in gastric and tracheobronchial mucosa. Specifically, high levels are localized in foveolar cells within the gastric epithelium and goblet cells in the trachea. MUC5AC expression was also reported in the gall bladder and endocervical epithelium.

Expression of mucin antigens are often altered in carcinomas due to changes in glycosylation. Neoplastic transformation has been associated with a decrease in MUC5AC expression. A study from Reis and colleagues in gastric carcinomas demonstrated loss of MUC5AC expression in over 50% of tumor cells.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0329A<br>1 ml . . . . . #AC-0329 | stomach, gastric carcinoma | cytoplasmic |



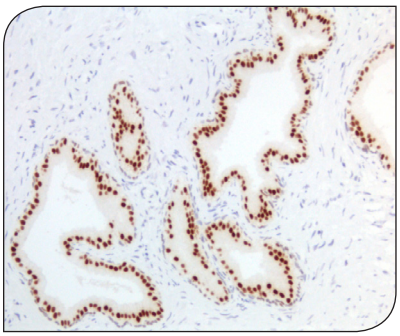
*Seminoma stained with anti-human Nanog*

## **Nanog** (EP225)

Nanog, a member of the homeobox family of DNA binding transcription factors, along with SOX2 and OCT3/4 form a regulatory network that facilitates embryonic stem cell (ESC) self-renewal and differentiation. Under normal development, Nanog is localized in the nucleus, expressed in the fetal testis, ovary, and gonads. It is not expressed in most somatic organs. While Nanog and other ESC-associated proteins are important for proper development, these have been shown to contribute to tumorigenesis.

Nanog is expressed in germ cell tumors such as embryonal carcinoma, seminoma and dysgerminoma. Recently, its expression has also been reported in non-germ cell tumors, such as carcinomas of the breast, cervix, oral cavity, kidney, and ovary.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0319A<br>1 ml . . . . . #AC-0319 | fetal testis, seminoma | nuclear, cytoplasmic |



*Prostate hyperplasia stained with anti-NKX3.1*

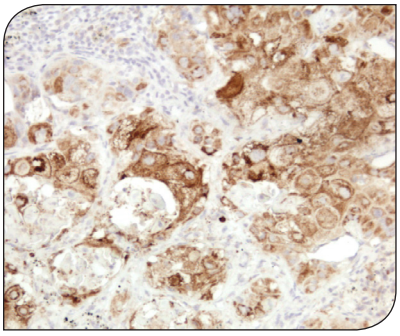
## **NKX3.1** (EP356)

NKX3.1 is a prostate-specific tumor suppressor homeodomain protein encoded by the NKX3.1 homeobox gene in chromosome 8p21. This protein is haploinsufficient and is frequently downregulated during early stages of carcinogenesis in premalignant lesions and prostatic intraepithelial neoplasia. Loss of heterozygosity is present in 60-80% of prostate tumors.

NKX3.1 is expressed in the normal prostatic epithelium, predominantly localized to the nucleus. Primary and metastatic prostatic adenocarcinoma have lower staining intensity compared to the normal prostate. It has been established as a highly sensitive and specific tissue marker of prostatic adenocarcinoma.

In a differential diagnostic setting, NKX3.1 is useful for differentiating prostatic from urothelial carcinoma, sensitivity ranged between 92-94%, along with a 100% specificity. A recent study also demonstrated NKX3.1 utility in identifying metastatic prostatic adenocarcinoma (98% sensitivity, 99% specificity). Combined in a panel with PSA and PSAP, all metastatic prostatic adenocarcinoma were positive for at least one marker.

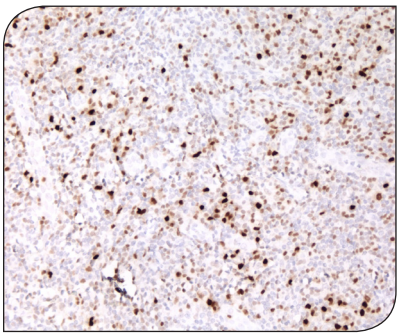
| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0314A<br>1 ml . . . . . #AC-0314 | prostate,<br>prostatic adenocarcinoma | nuclear |



## **ROS1** (EP282)

Analyte Specific Reagent: Analytical and performance characteristics are not determined.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0271A<br>1 ml . . . . . #AC-0271 | N/A | membranous, cytoplasmic |



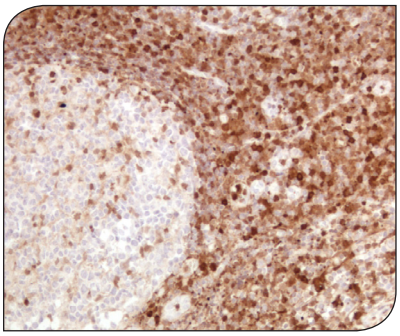
*Tonsil stained with anti-RUNX2*

## **RUNX2** (EP351)

Runt-related transcription factor 2 (RUNX2) is a member of the Runx transcription factor family that regulates the differentiation of osteogenic and chondrogenic cells from mesenchymal precursors. *RUNX2* is expressed in developing osteoblasts and progressively decreases during maturation. Overexpressing *RUNX2* induces a high rate of bone turnover.

Of the Runx family members, RUNX1 and RUNX2 have been associated with oncogenesis. Aberrant function of RUNX2 has been implicated in oncogenesis and pathogenesis of some bone tumors including osteosarcoma and giant cell tumor. A large immunohistochemical study of 206 bone tumors revealed RUNX2 expression in the majority of osteoblastomas (90%, 19/21), osteoid osteomas (100%, 5/5), and osteosarcomas (93%, 66/71). Using an antibody panel containing RUNX2, TWIST1 and SOX9, giant cell tumors (RUNX2+, TWIST1-) and osteosarcoma (RUNX2+, TWIST1+) could be reliably differentiated from chondroblastoma and chondromyxoid fibroma (RUNX2-, SOX9+) with high sensitivity and specificity. Addition of RUNX2 immunohistochemistry may aid in the diagnosis of osteosarcoma.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0321A<br>1 ml . . . . . #AC-0321 | placenta, osteosarcoma | nuclear |



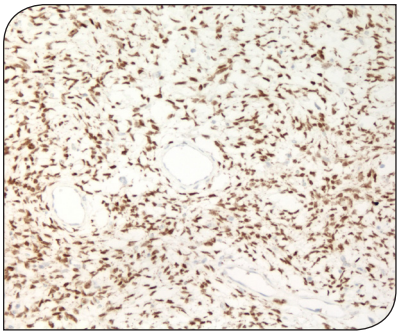
*Tonsil stained with anti-human S100A4*

## **S100A4** (EP360)

S100 calcium-binding protein A4 (S100A4) is a member of the S100 family of calcium binding proteins. S100A4 is encoded with other S100 family members on chromosome 1q21. This protein has been suggested in modulating cellular functions such motility, invasion, cell cycle progression and differentiation. *In vitro* studies demonstrated S100A4 interaction with the C terminus of p53 to promote degradation and inhibition of protein kinase C phosphorylation.

S100A4 has been shown to be a prognostic marker in a number of human cancers, including carcinomas of breast, esophagus, lung, gastric, prostate, bladder and pancreas. Immunohistochemical analysis shows elevated S100A4 expression compared with normal tissue. Carcinomas that stain positively for S100A4 expression are highly correlated with poor prognosis, suggesting that enhanced S100A4 expression contributes to manifestation of a metastatic phenotype.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml . . . . . #AC-0331RUO<br>1 ml . . . . #AC-0331RUOC | tonsil, breast carcinoma | cytoplasmic |



*Solitary fibrous tumor stained with anti-human STAT6*

## **STAT6** (EP325)

Signal Transducer and Activator of Transcription 6 (STAT6) is a transcription factor in the Jak/STAT signal transduction pathway responsible for mediating IL-4 immune signaling. STAT6 was recently suggested to be a reliable marker to distinguish solitary fibrous tumors from other soft tissue neoplasms. Gene fusions are common in solitary fibrous tumors. Recent next generation sequencing studies demonstrated the presence of a NAB2-STAT6 fusion, formed by an intrachromosomal inversion fusing two neighboring genes on chromosome 12q13, in 55-100% of solitary fibrous tumors, regardless of tumor morphology or anatomical site. Analysis is further complicated due to the difficulty in detecting this fusion by fluorescence in situ hybridization (FISH).

Solitary fibrous tumors are classically characterized by CD34 positive spindle cells. However, approximately 5-10% of these tumors are negative for CD34, posing challenges for differential diagnosis. By immunohistochemistry, nuclear STAT6 expression can discriminate solitary fibrous tumors from its morphological mimics in the meninges, including meningioma, glioblastoma, gliosarcoma, haemangioblastoma, schwannoma and haemangioma. A recent study by Cheah, et al. using the rabbit monoclonal STAT6 antibody (Clone YE361) observed expression in all solitary fibrous tumors (54/54) tested, regardless of histology, anatomical site or CD34 status. Morphological mimics of solitary fibrous tumors were negative, demonstrating 100% specificity.

| Concentrate Part No.: | Control: | Visualization: |
|---|---|---|
| 0.1 ml..... #AC-0318A<br>1 ml .....#AC-0318 | solitary fibrous tumor | nuclear, cytoplasmic |

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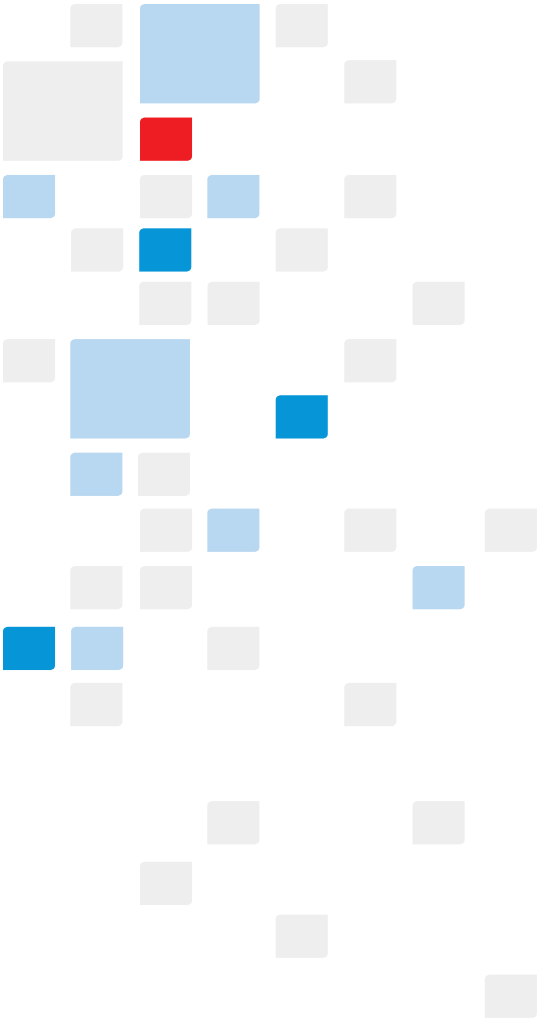

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REA_D151A_Supplement EP Klone Vol. 2 - 10/2016 abi