International Symposium on Immunohistochemistry
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Hosted by Dept. of Histopathology, Tata Medical Center, Kolkata, India
In collaboration with NordiQC, Alborg, Denmark and ISIMM, California, USA

Diagnostic IHC in GI and liver pathology

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“GI markers”

CDX2

CAD17

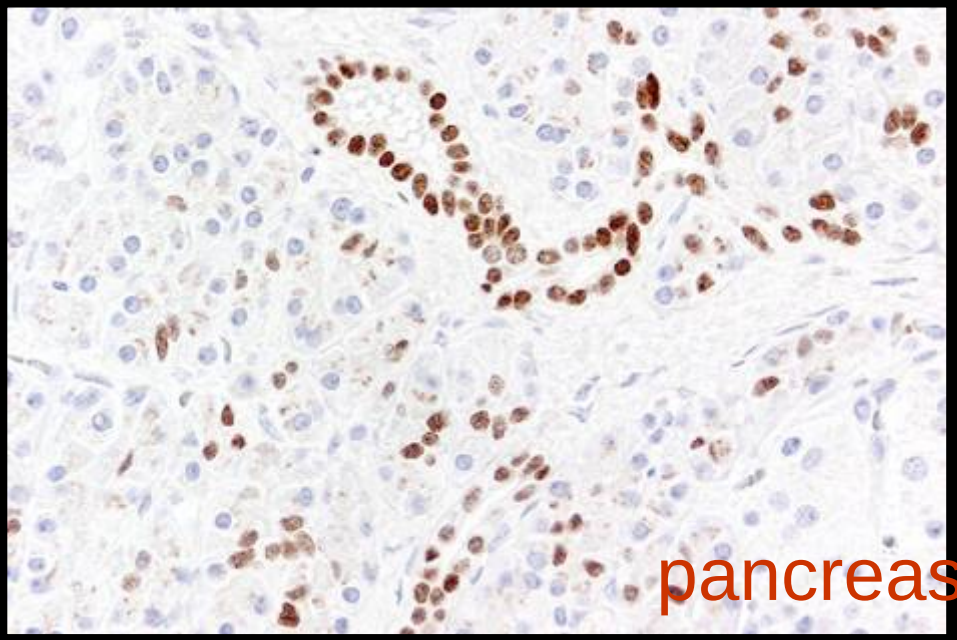
SATB2

CEA

CDX-2 protein

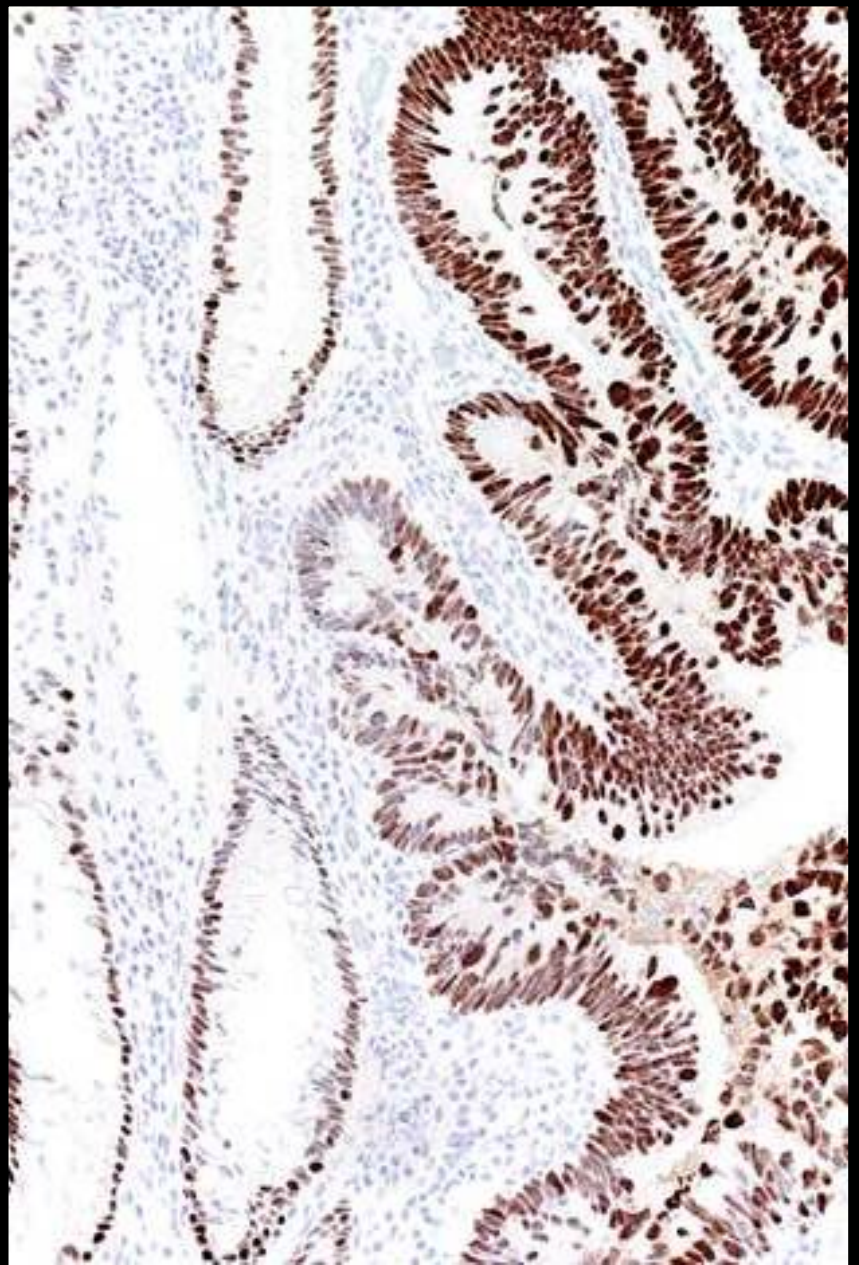
- Drosophila caudal related homeobox gene 2 product:
- Nuclear transcription factor
- for intestinal differentiation

- Intestine
  - all cell types incl. endocrine
- Intestinal metaplasia
  - chronic gastritis
  - Barrett's esophagus
- Pancreas/bil.tract



CDX-2 protein in adenocarcinoma

- Colorectum +(–)
- Mucinous ovar. +(–)
- Esoph./Stom. +/–
- Mucinous lung +/–
- Pancr./biliary –/+
- Prostate –(+)
- Urothelial –(+)
- Endometrioid –(+)
- Endocrine midgut +
- Yolk sac tumour +



Colon adenocarcinoma

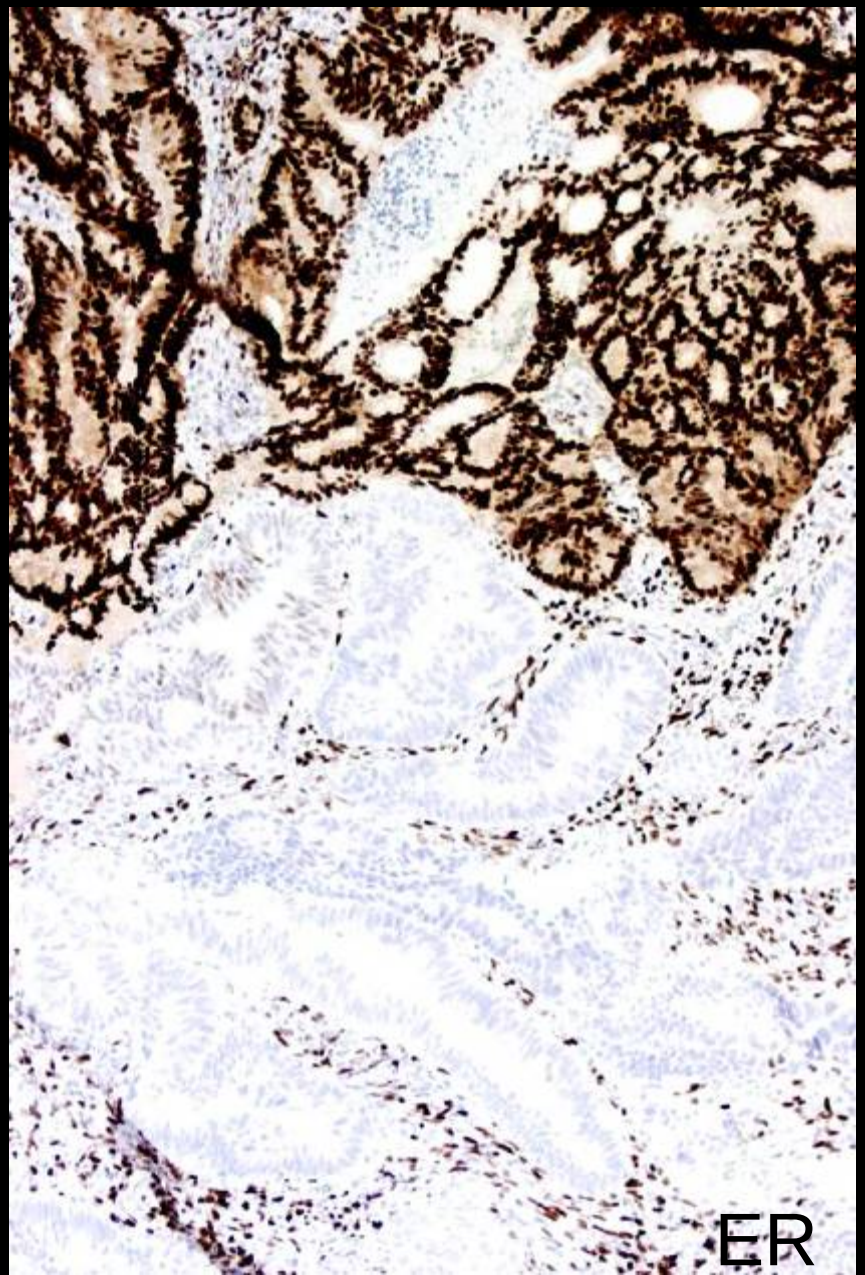
CDX-2 protein in adenocarcinoma

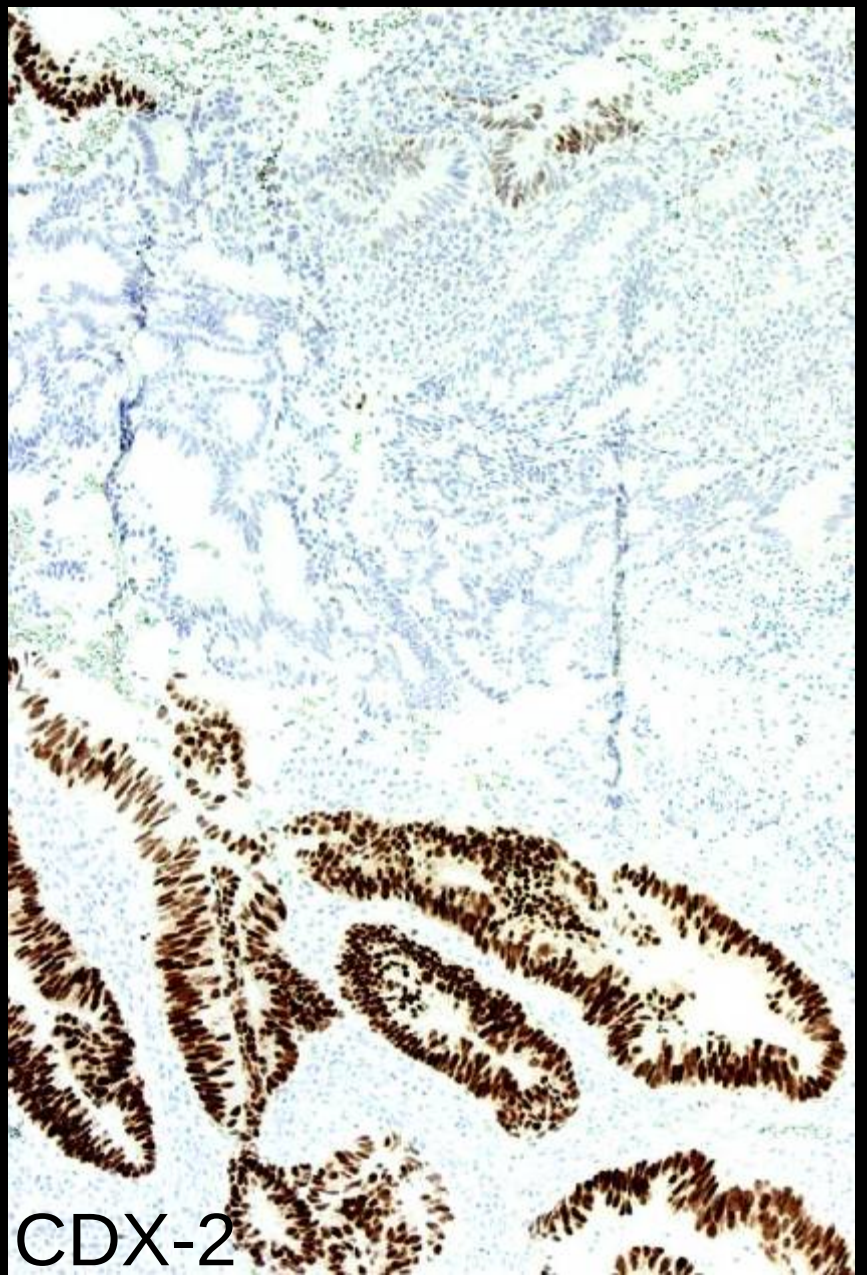
- Colorectum +(–)
- Mucinous ovar. +(–)
- Esoph./Stom. +/–
- Mucinous lung +/–
- Pancr./biliary –/+
- Prostate –(+)
- Urothelial –(+)
- Endometrioid –(+)
- Endocrine midgut +
- Yolk sac tumour +

Colon medullary adenoc.

Colon adenosquamous carc.

Endometrioid carcinoma: ER & CDX-2





Quality assurance of CDX2 detection

RESEARCH ARTICLE

(*Appl Immunohistochem Mol Morphol* 2013;21:64–72)

Demonstration of CDX2 is Highly Antibody Dependant

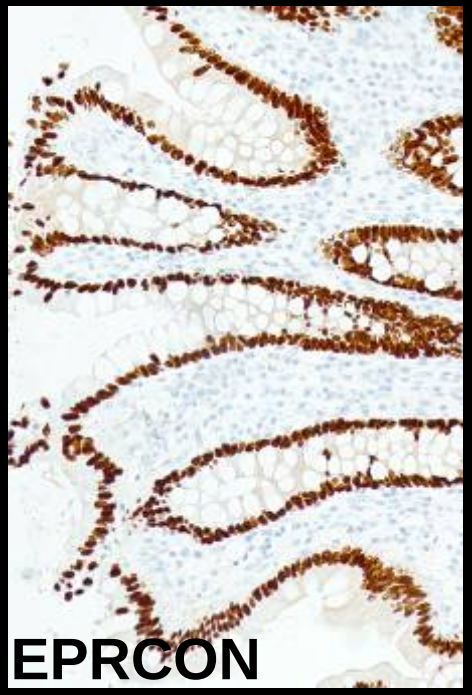
Martine Borrisholt, MS, Søren Nielsen, HT, and Mogens Vyberg, MD

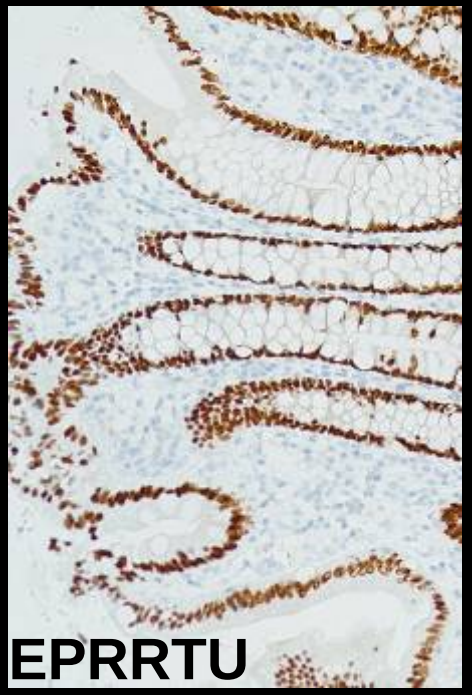
	N	EPR* CONC	EPR RTU	DAK-CDX2	AMT-28	CDX2-88
High Ex	54	265	240	234	171	155
		100%	100%	100%	98%	96%
Low Ex	52	55	27	27	8	5
		95%	48%	58%	19%	13%

- Mean H-score and proportion of positives

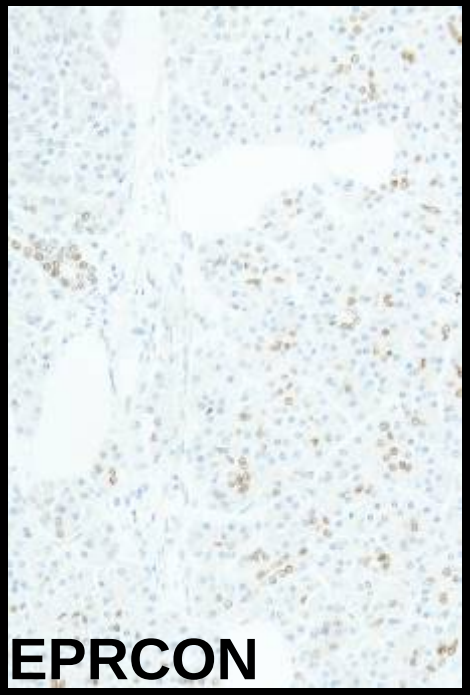
*rmAb EPR2764Y (Ventana, CellMarque)

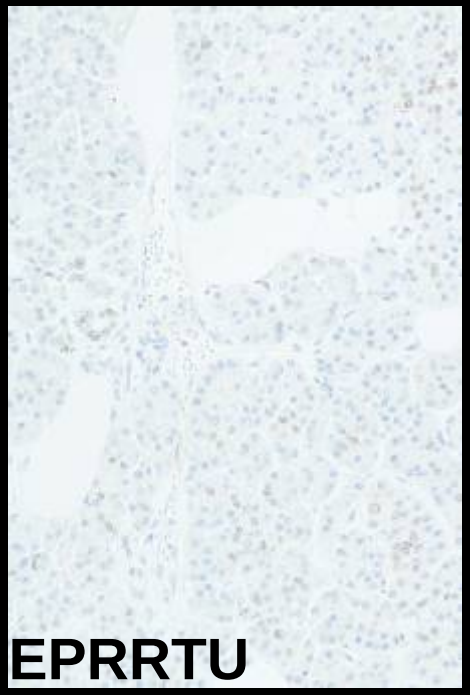
CDX2
Normal
colon 1

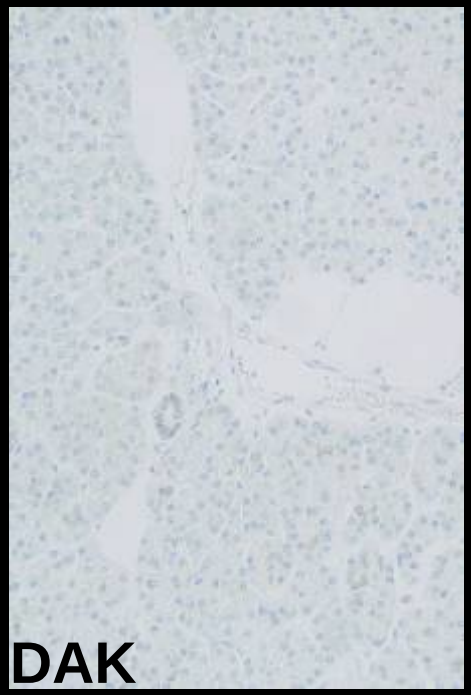


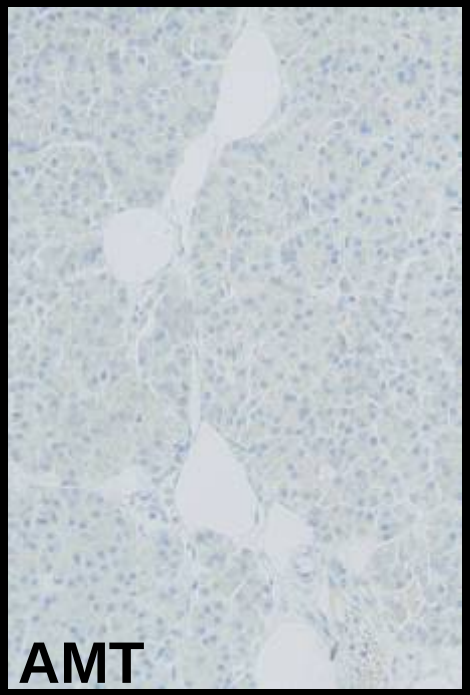


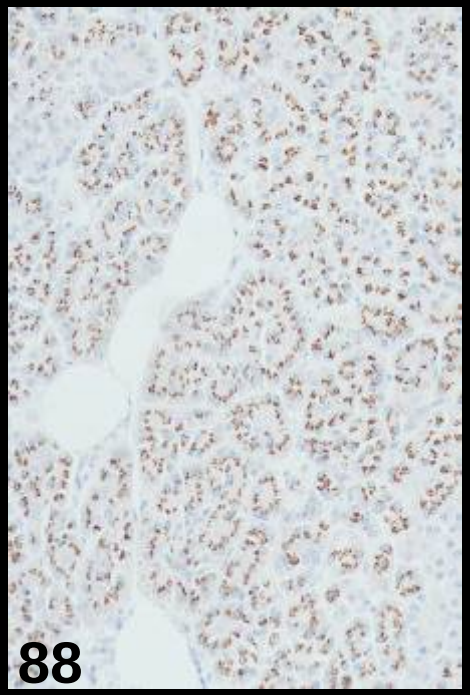
CDX2
Normal
pancreas



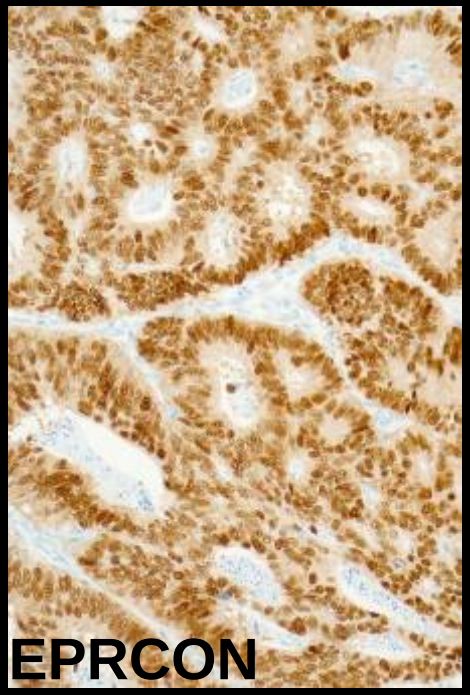


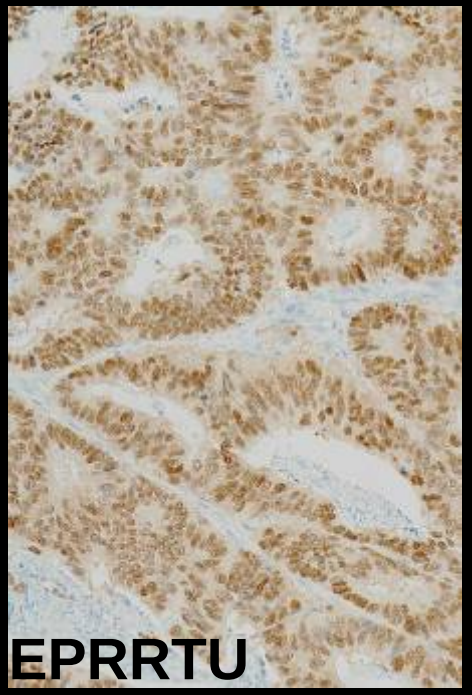


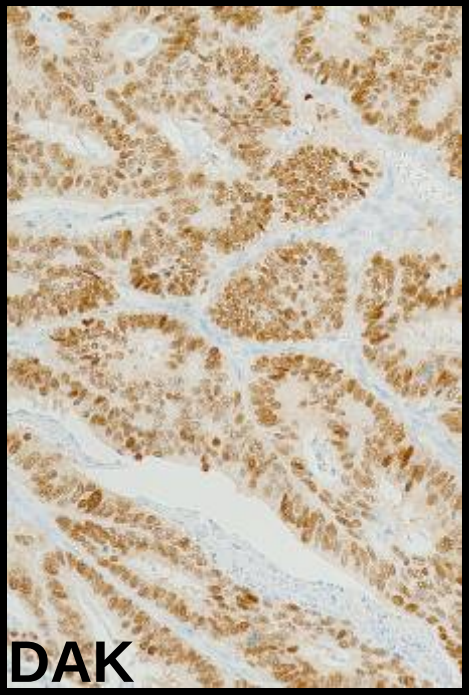


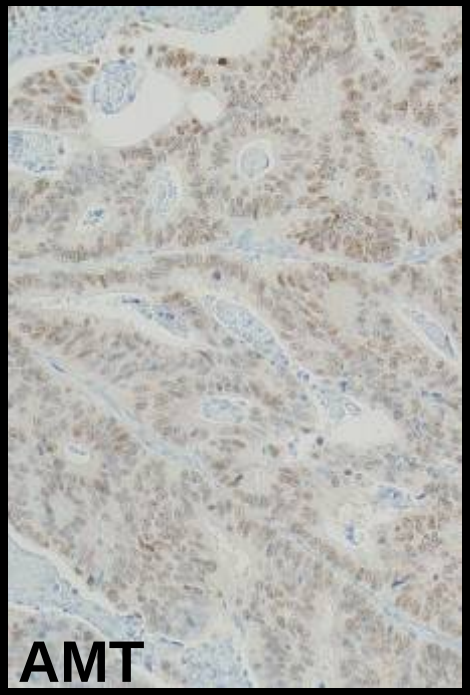


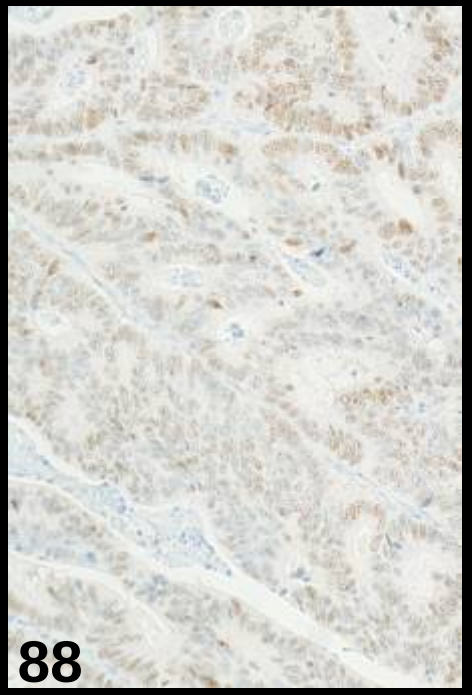
CDX2
Colon
adenocarc





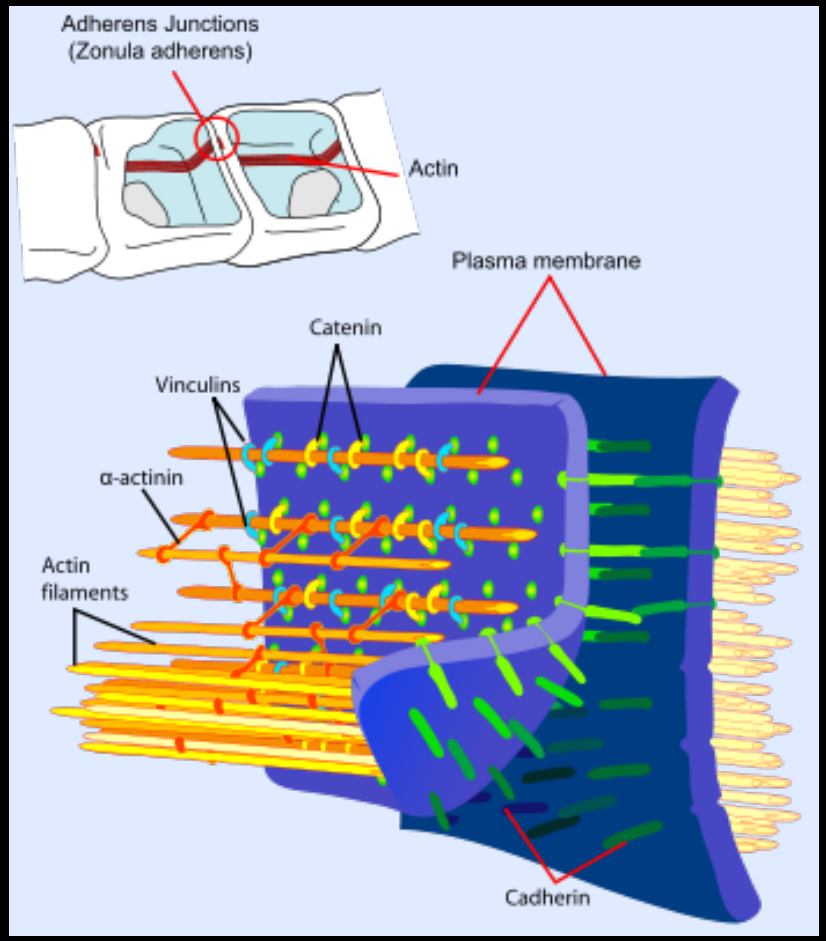






Cadherin 17

- **Calcium dependent adhesion molecules**
- **CAD17 = Liver-Intestine (LI-) Cadherin**
- **Regulated by CDX2**
- **Intestine, pancreas**

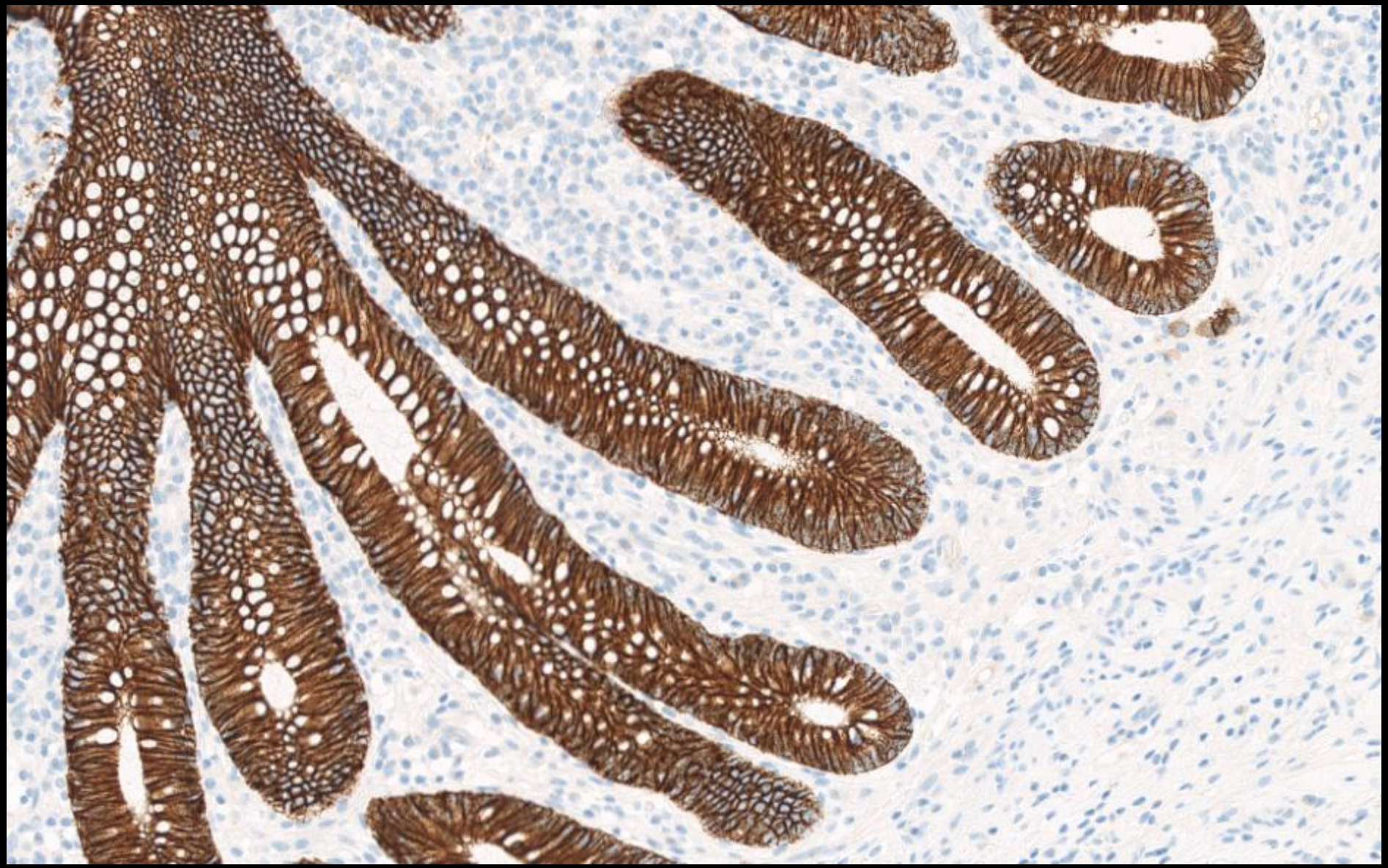


Cadherin 17

- Adenocarcinoma, colon + (100%)
- Adenocarc., esophagus, stomach, pancreas biliary tract +/− (often heterogenous)
- Adenocarc., lung, endometrium, ovary, breast −(+) (focal)

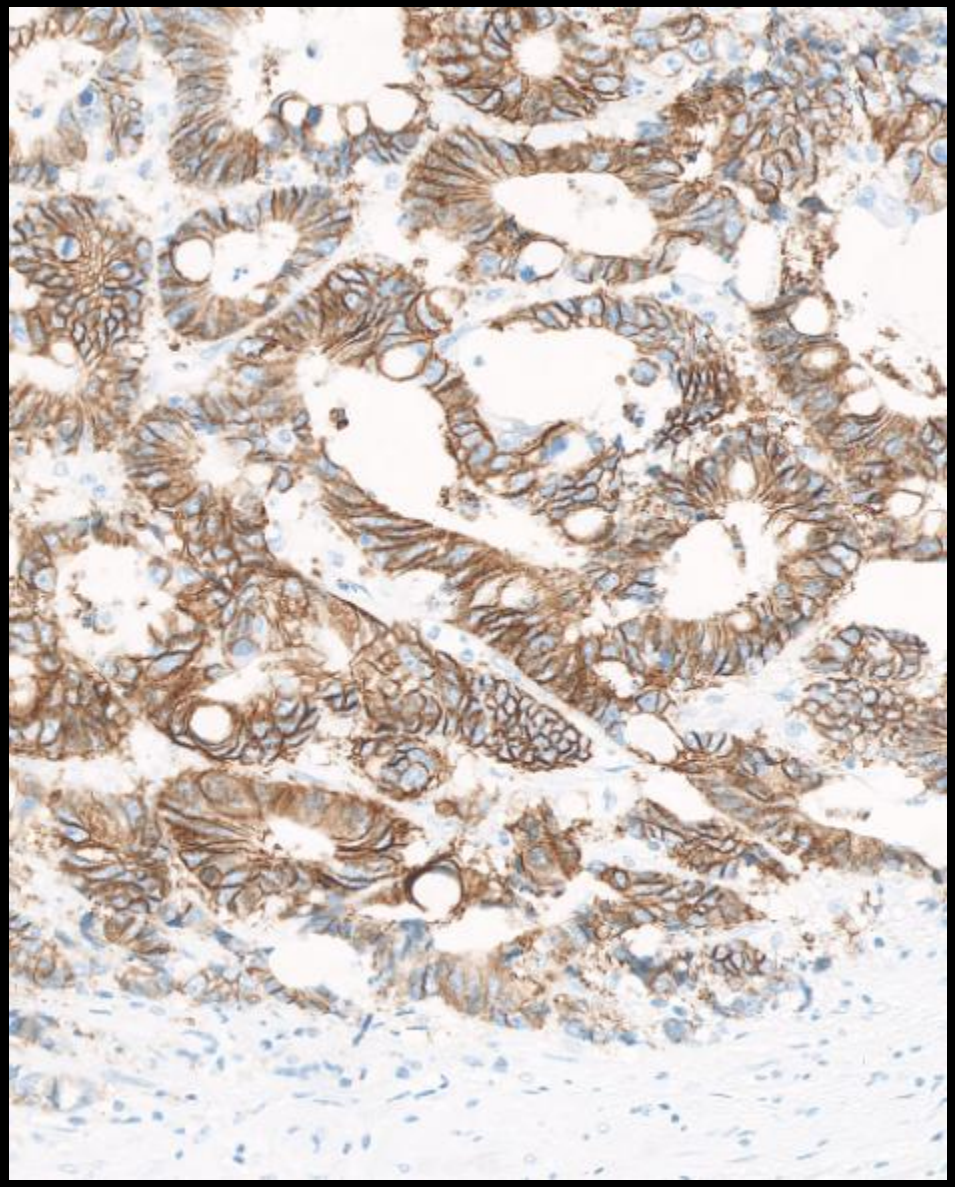
- Neuroendocrine tumour, small intest + (100%)
- Neuroendocrine tumour, lung, pancr. −/+
- Squamous cell carc. −(+)
- Hepatocellular carc. −(+)

CAD17 – Appendix

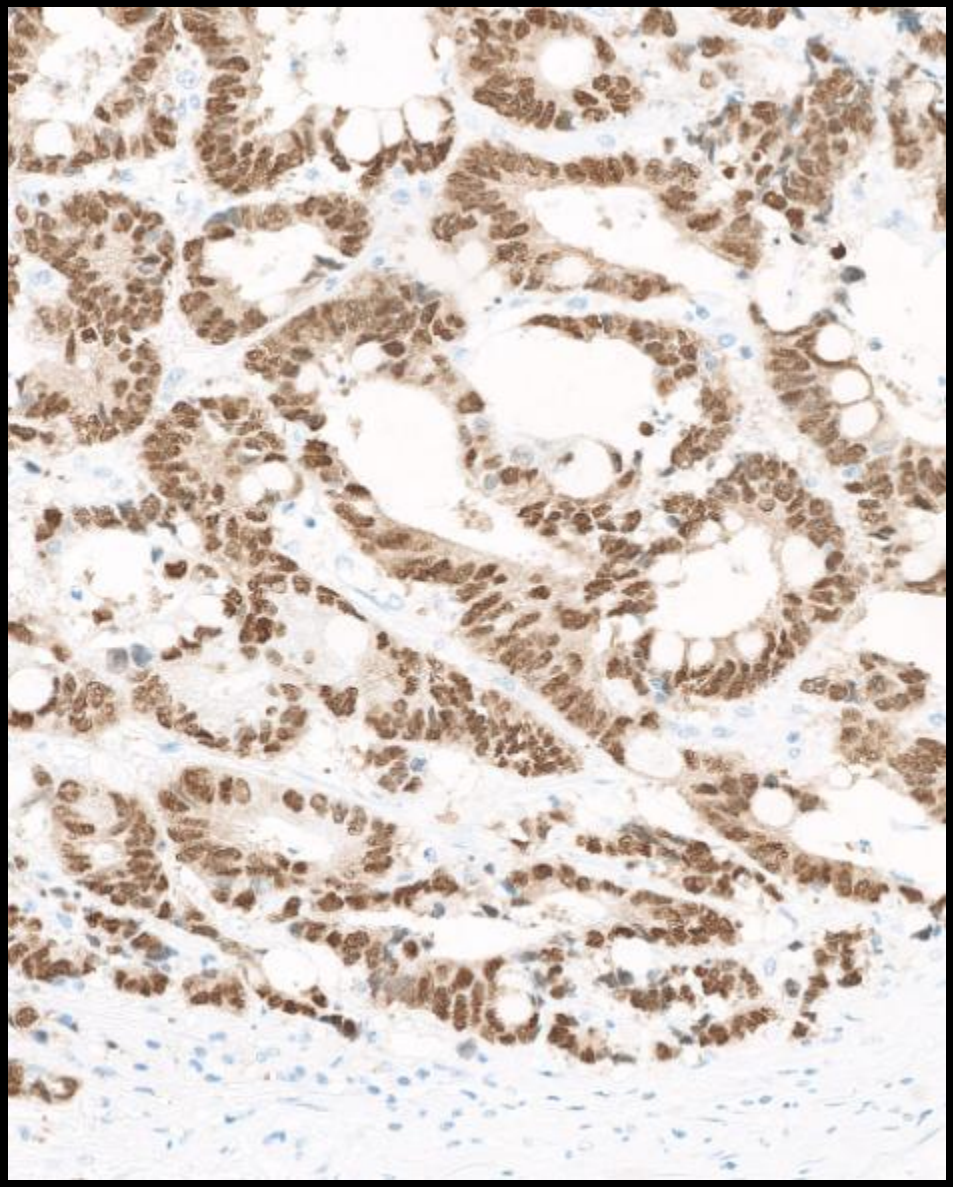


Cadherin 17: rmAb SP183, CM, 1:50,
CC1M/16M/UV

CAD17 and CDX2 – Colon adenocarcinoma

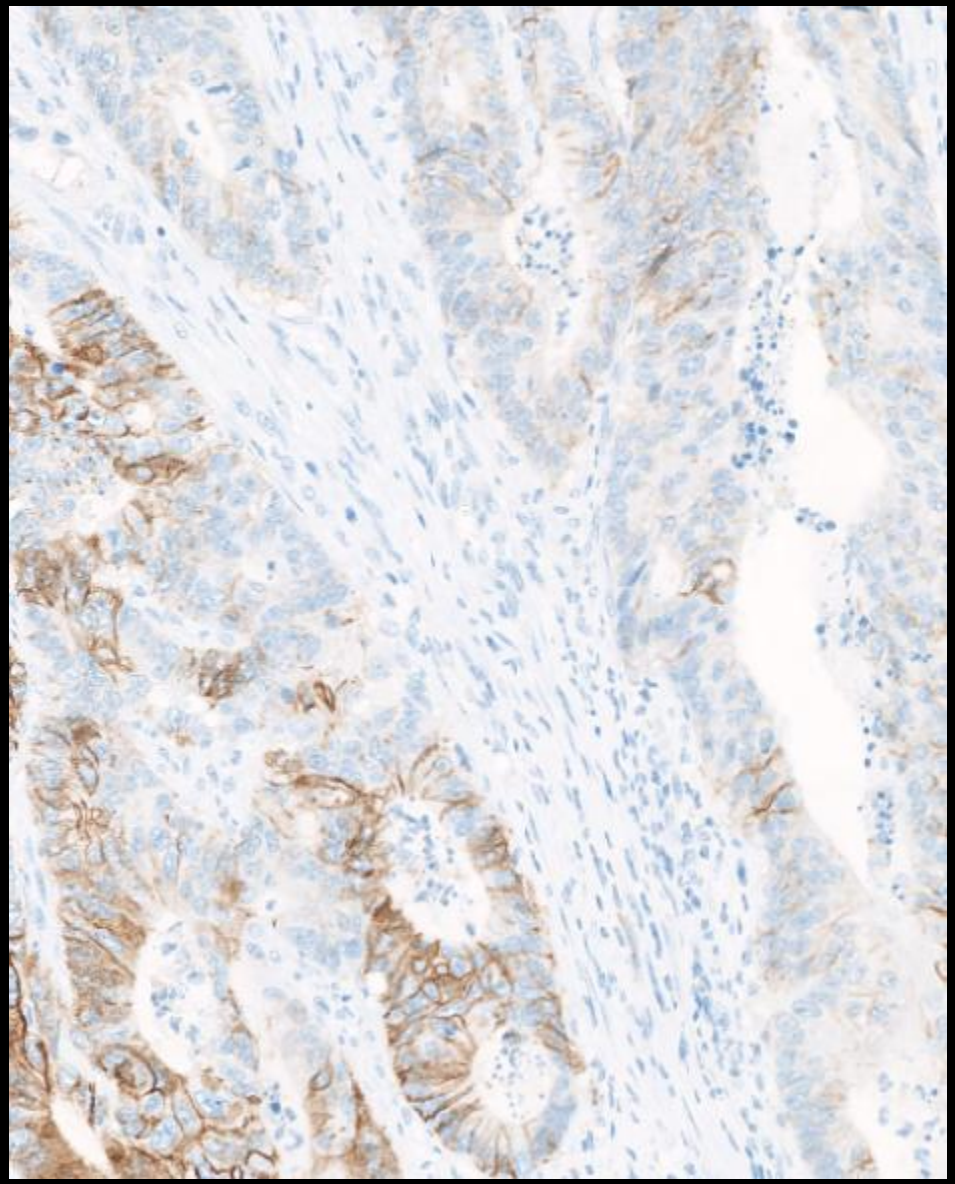


Cadherin 17: rmAb SP183, CM, 1:50, CC1M/16M/UV

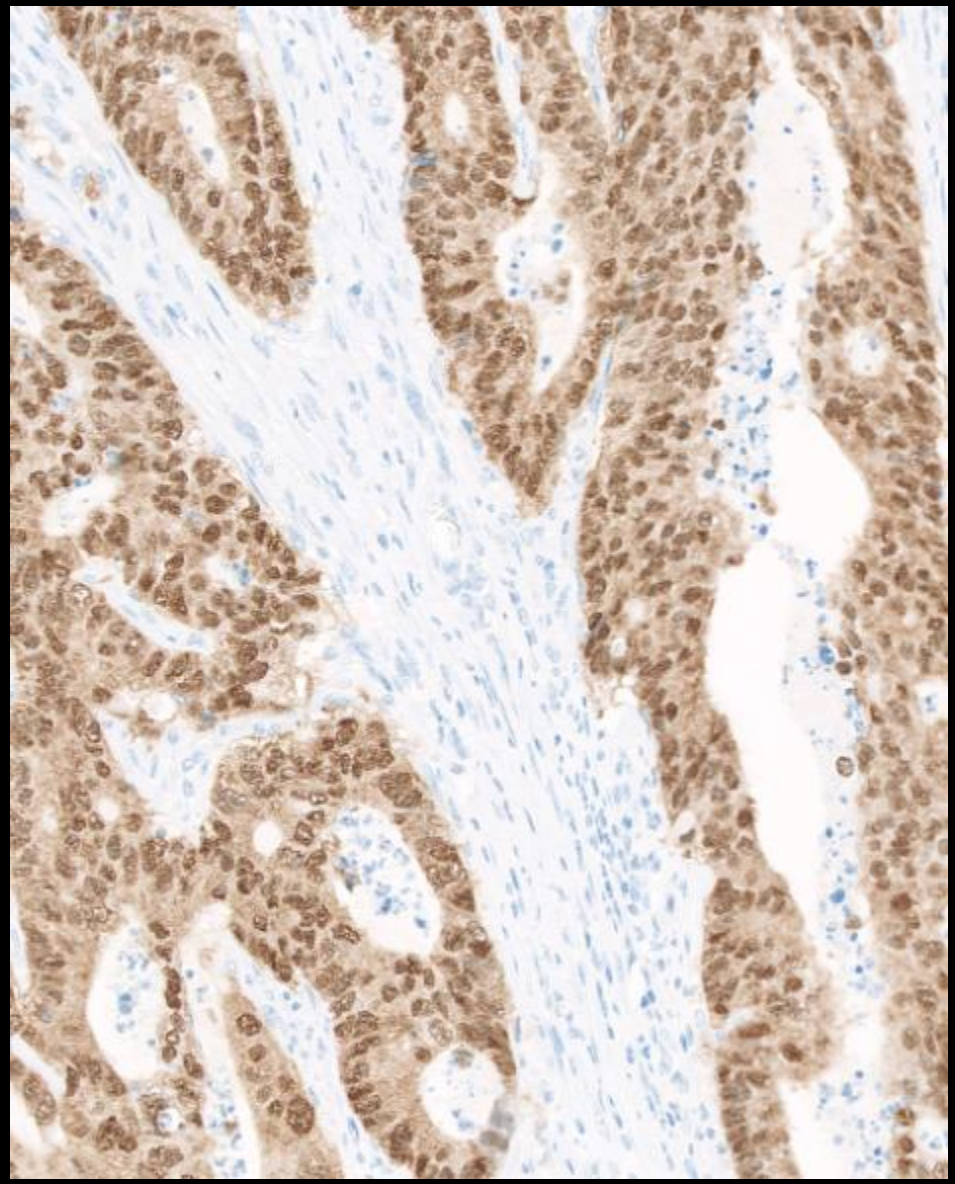


CDX2:
rmAb EPR2764Y, CM

CAD17 and CDX2 – Colon adenocarcinoma

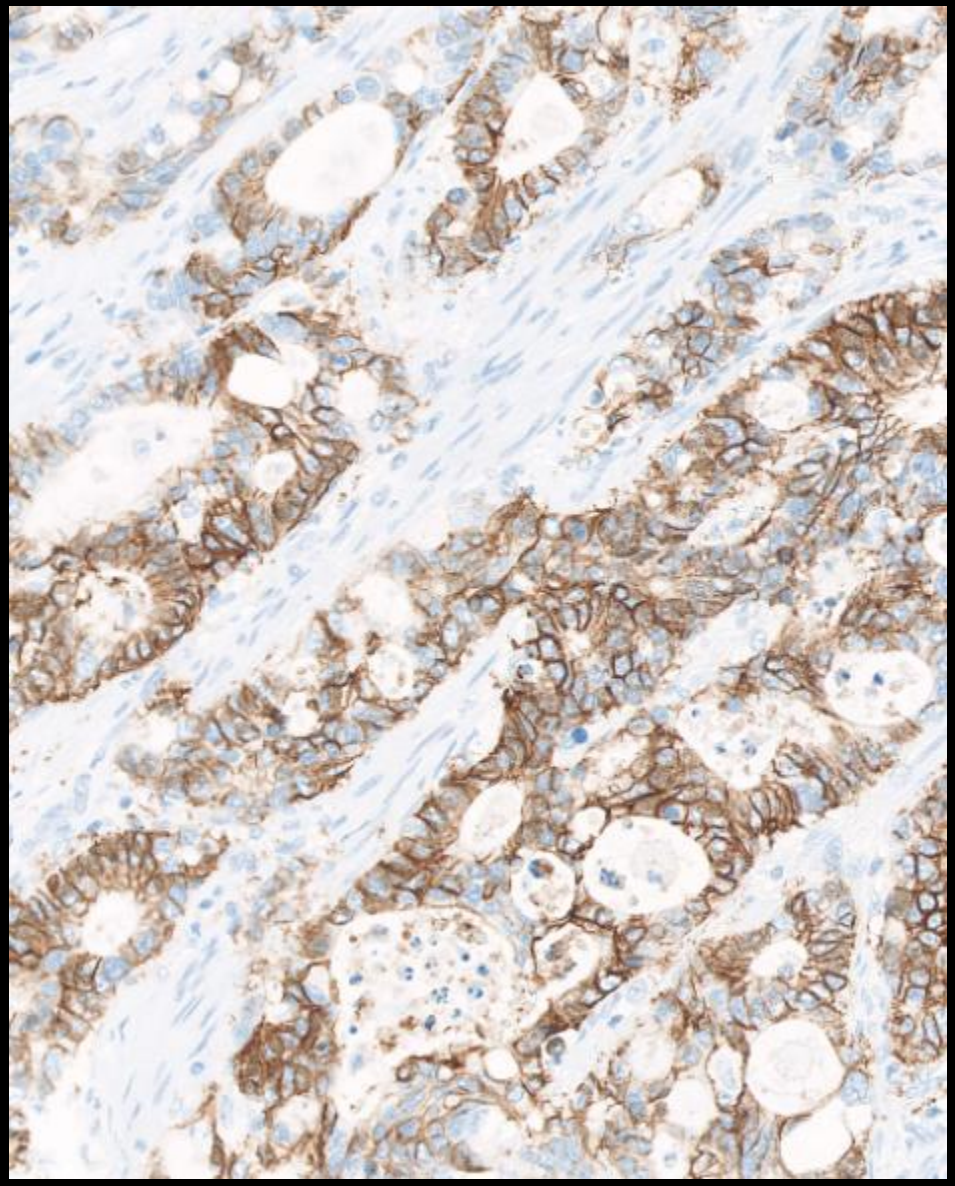


Cadherin 17: rmAb SP183, CM, 1:50, CC1M/16M/UV

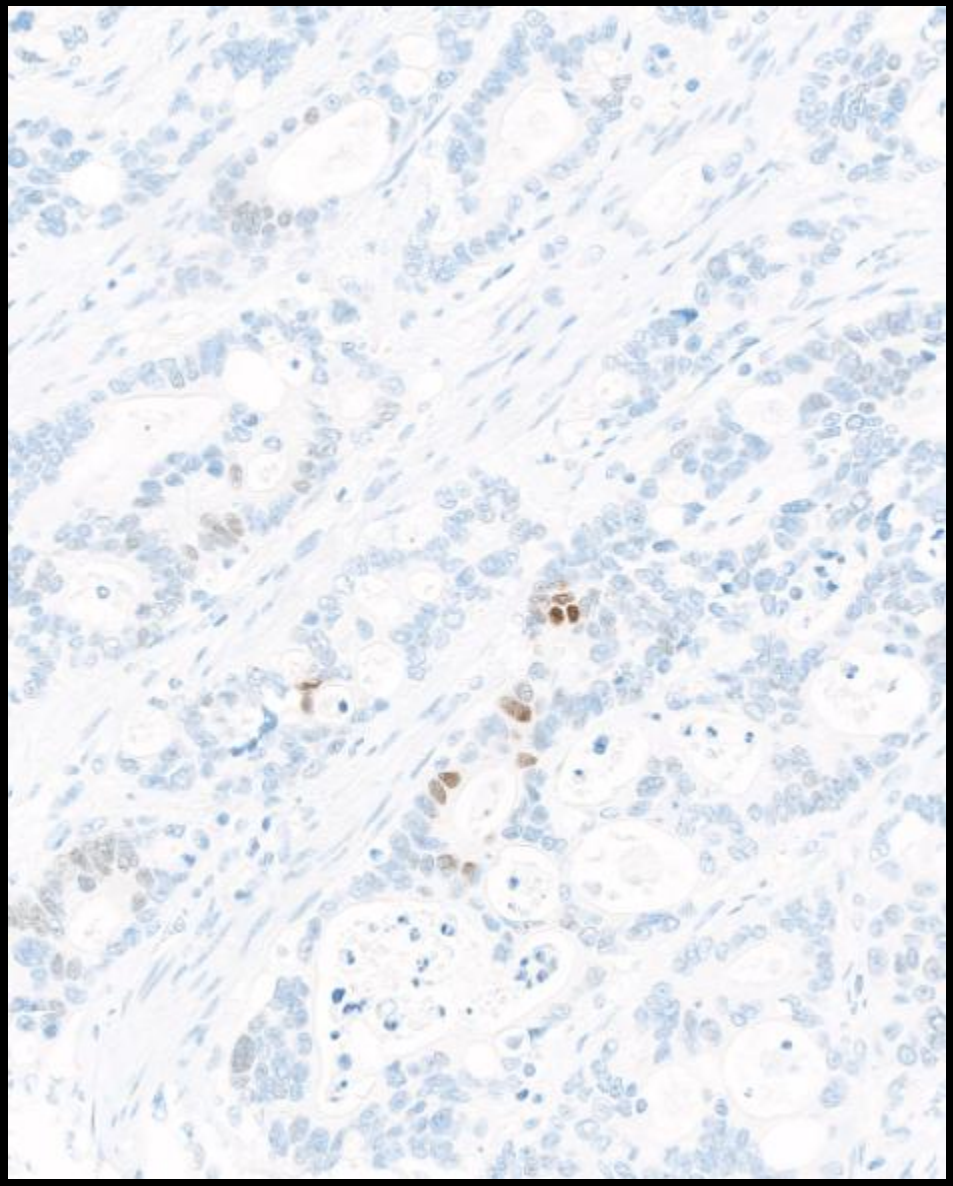


CDX2:
rmAb EPR2764Y, CM

CAD17 and CDX2 – Colon adenocarcinoma

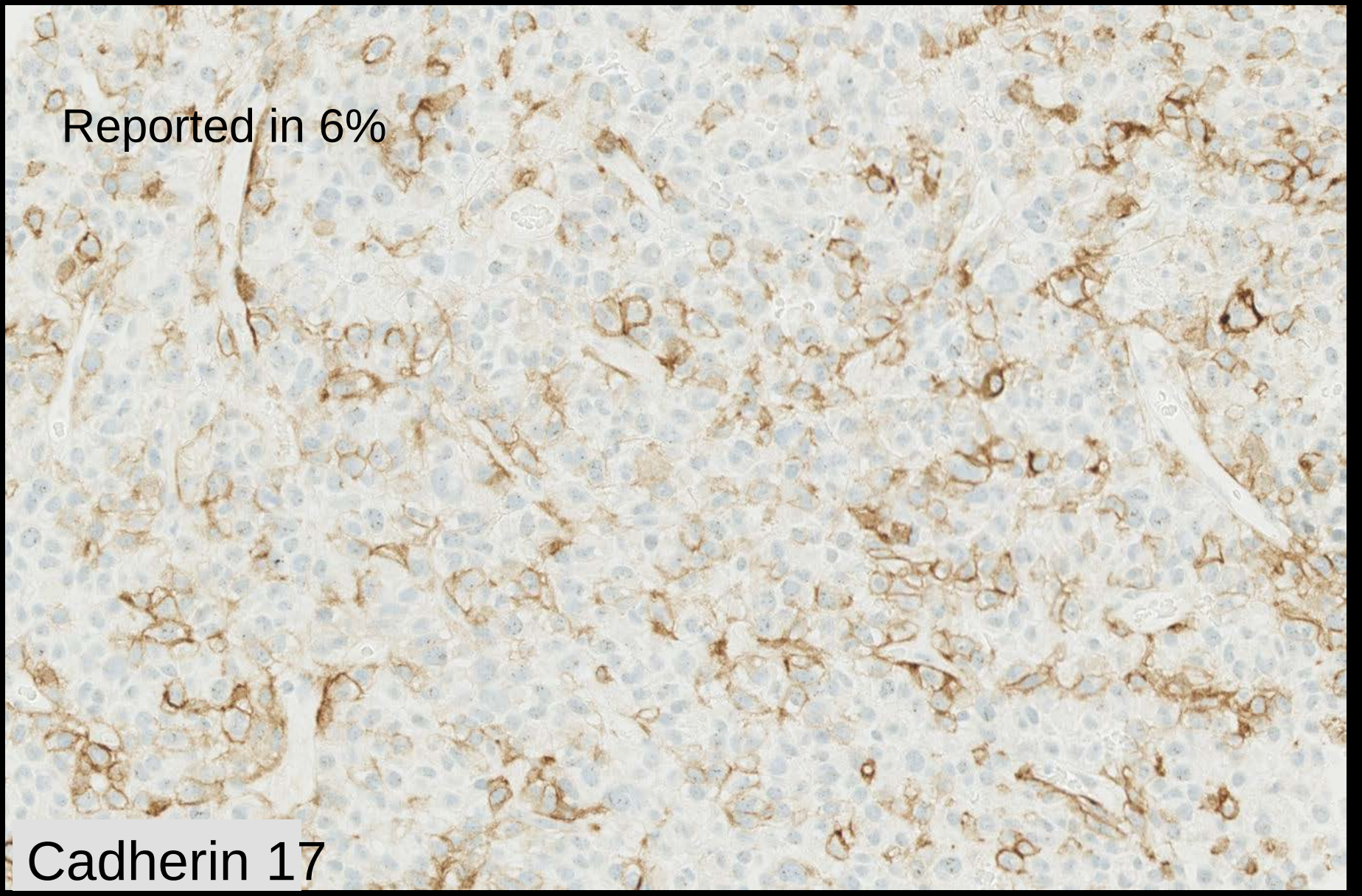


Cadherin 17: rmAb SP183, CM, 1:50, CC1M/16M/UV



CDX2:
rmAb EPR2764Y, CM

Cadherin 17 in hepatocellular carcinoma

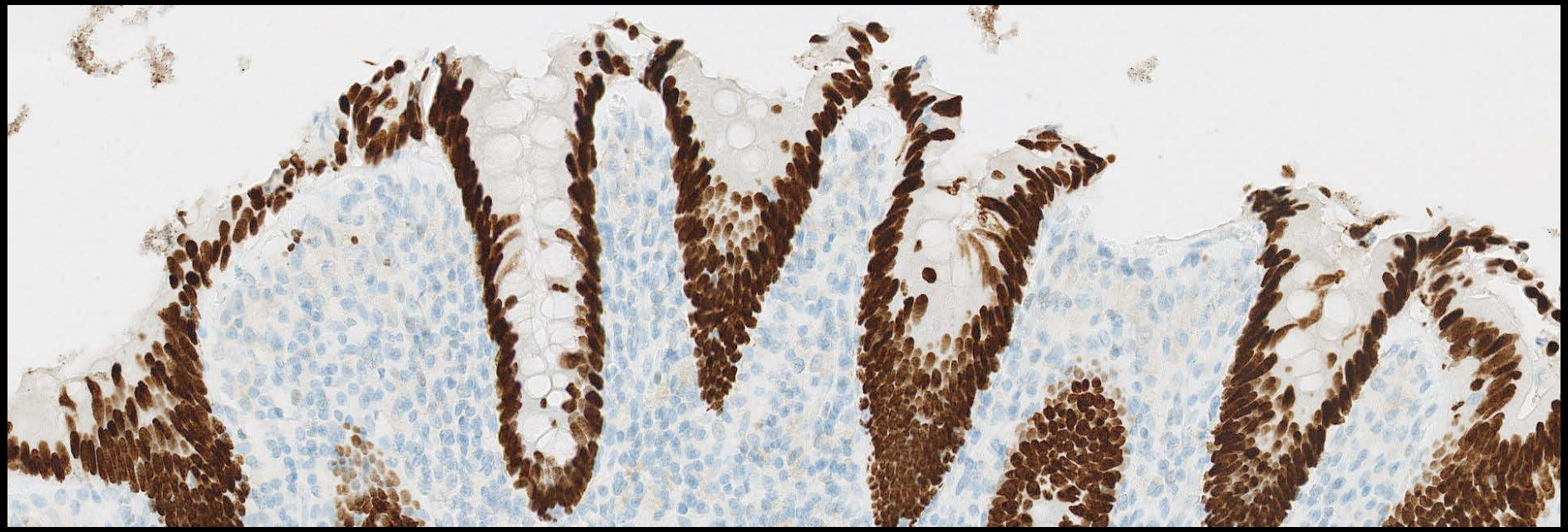


SATB2 – **rMab SP281 CM**

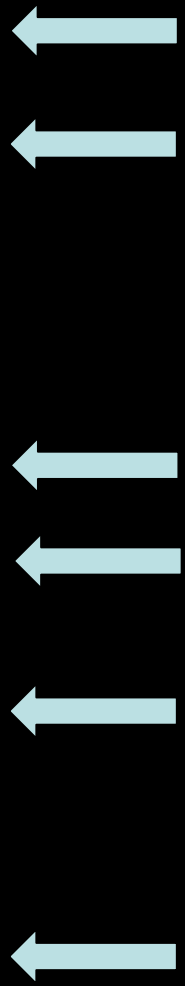
Special Adenine Thymine-rich sequence-binding protein 2

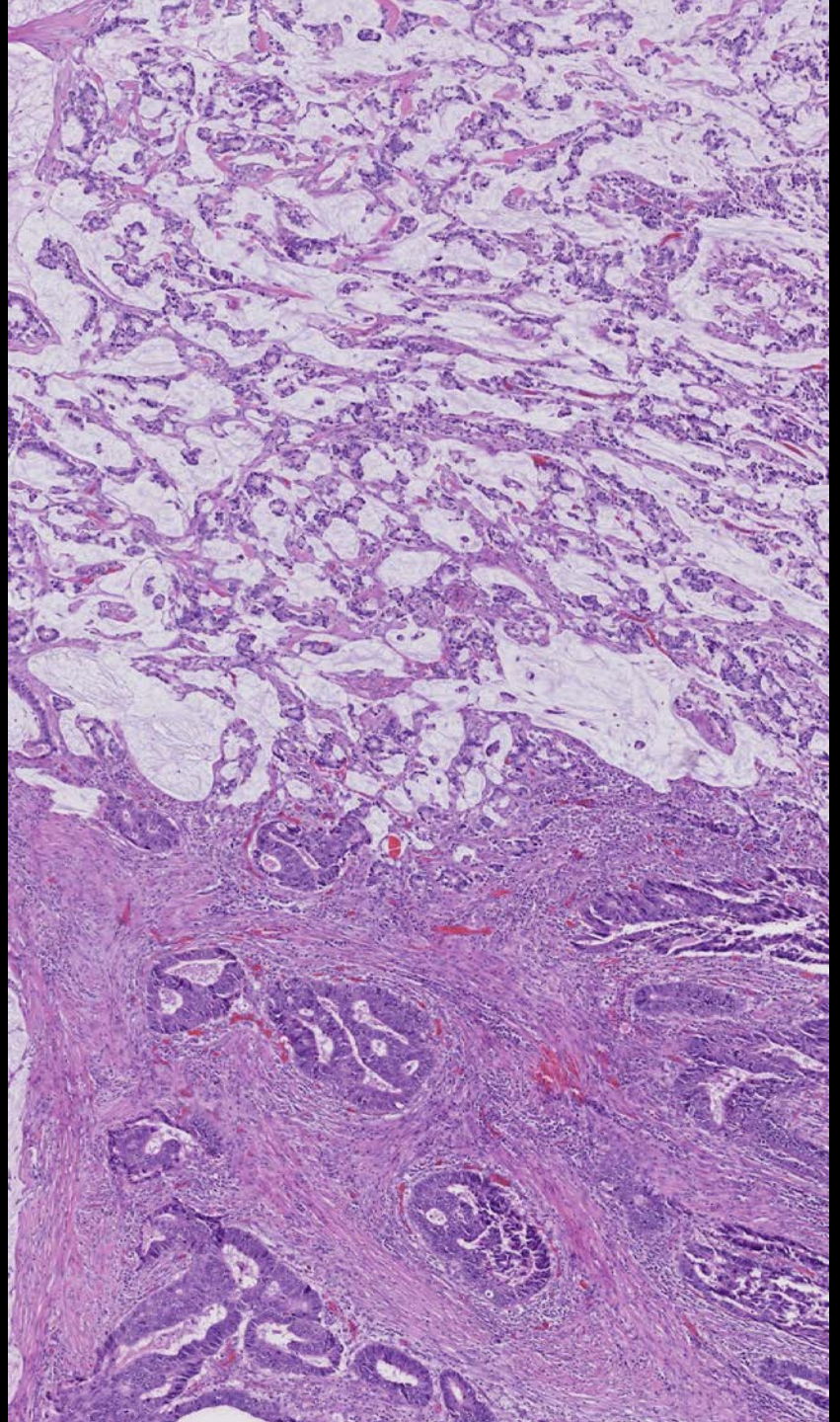
Nuclear matrix-associated transcription factor of intestine, neurons and osteoblasts

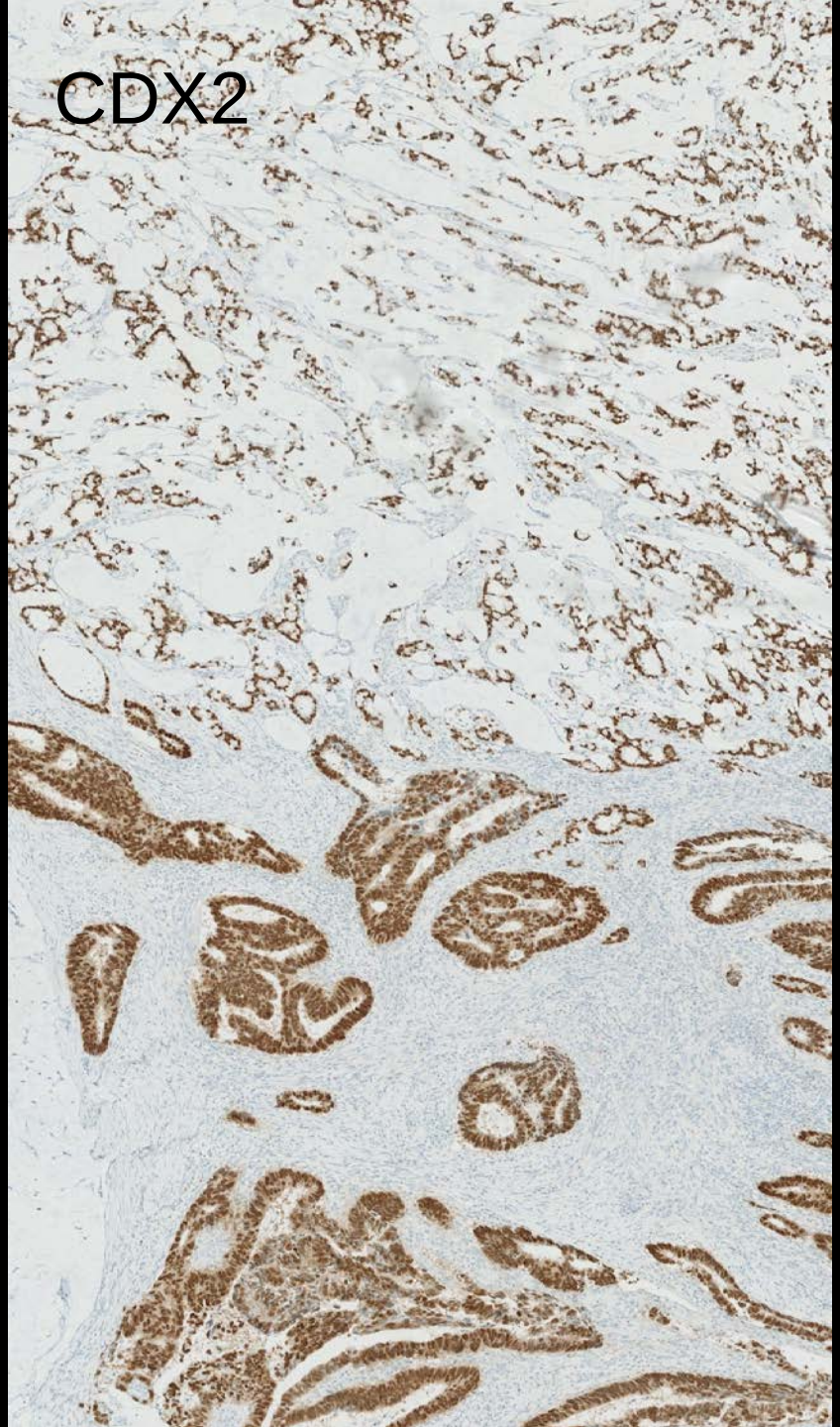
- Colorectal adenocarcinomas +/(-)
- Renal cell carcinoma -/+
- Other carcinomas –/+ (f)
- Neuroendocrine neoplasms –(+)

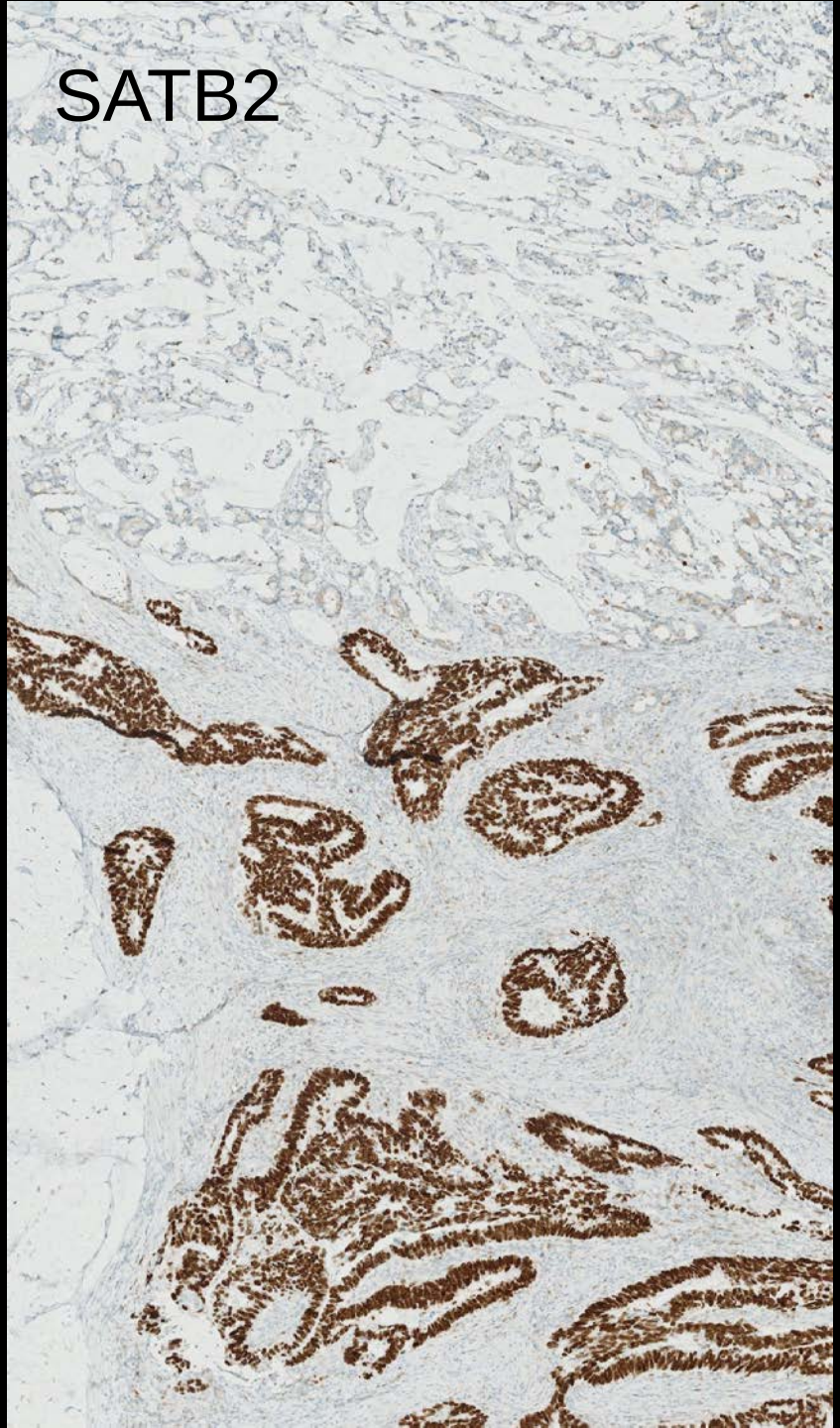


Epithelial tumours	CDX2	CAD17	SATB2
Esophagus adenoc.	+/-	+/-	-/+
Stomach adenoc.	**+/-**	**-/+**	**-(+)**
Pancreas adenoc.	-/+	-/+	-(+)
Small intestine adenoc.	**+/-**	**+/-**	**-/+**[f]
Colorectum adenoc.	+(-)	+(-)	+(-)
Urinary tract adenoc.	-/+	+/-	-/+
Urinary tract urothelial c.	-(+)	-(+)	-/+
Ovary mucinous adenoc.	-/+	-/+	**-(+)**
Ovary endometrioid adenoc.	-(+)	-(+)	-(+)
Endocervix adenoc.	-/+	-/+	**-(+)**
Lung adenocarc.	-(+)	-(+)	-(+)
Lung enteric adenoc.	**+/-**	**-(+)**	**-(+)**
Lung squamous c.	-	-	-(+)
Foregut endocrine WD	-/+	-(+)	-/+
Midgut endocrine WD	**+/-**	**+(-)**	**-(+)**
Hindgut endocrine WD	**-(+)**	**-(+)**	**+(-)**
Renal clear cell adenoc.	-	-	-(+)
Renal papillary adenoc.	-	-	-/+
Merkel cell carcinoma	-	-	+/-



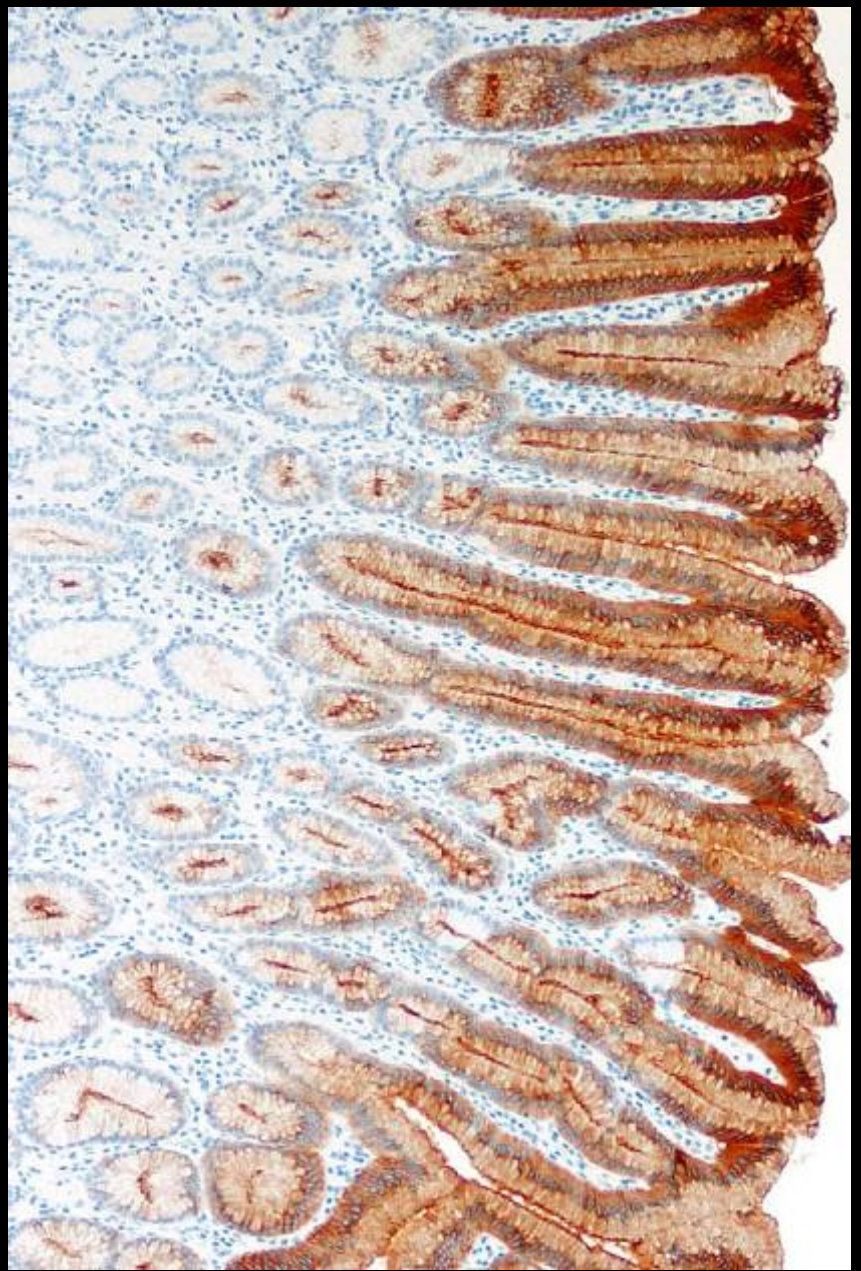




CDX2


SATB2

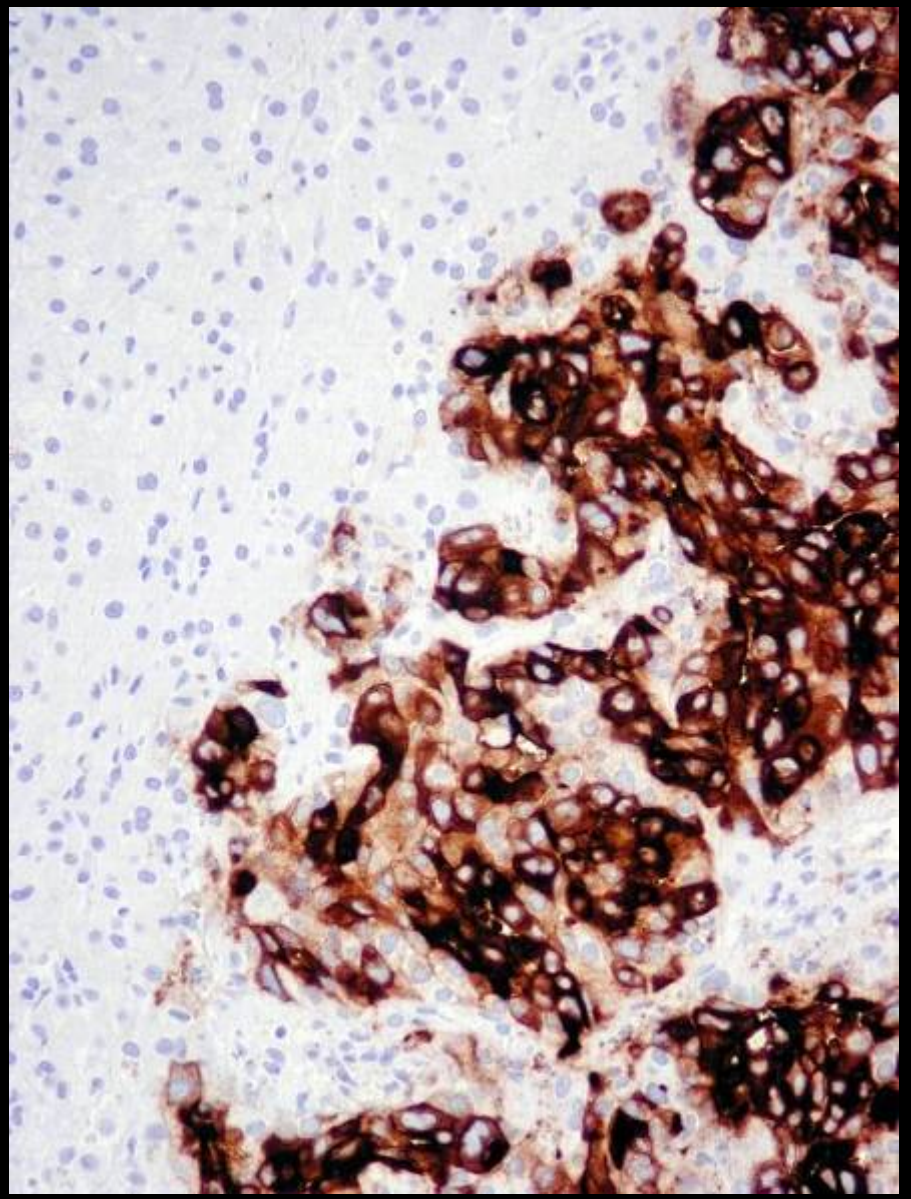
Carcinoembryonic antigen (CD66e)

- Adhesion molecule espc. associated with intestine



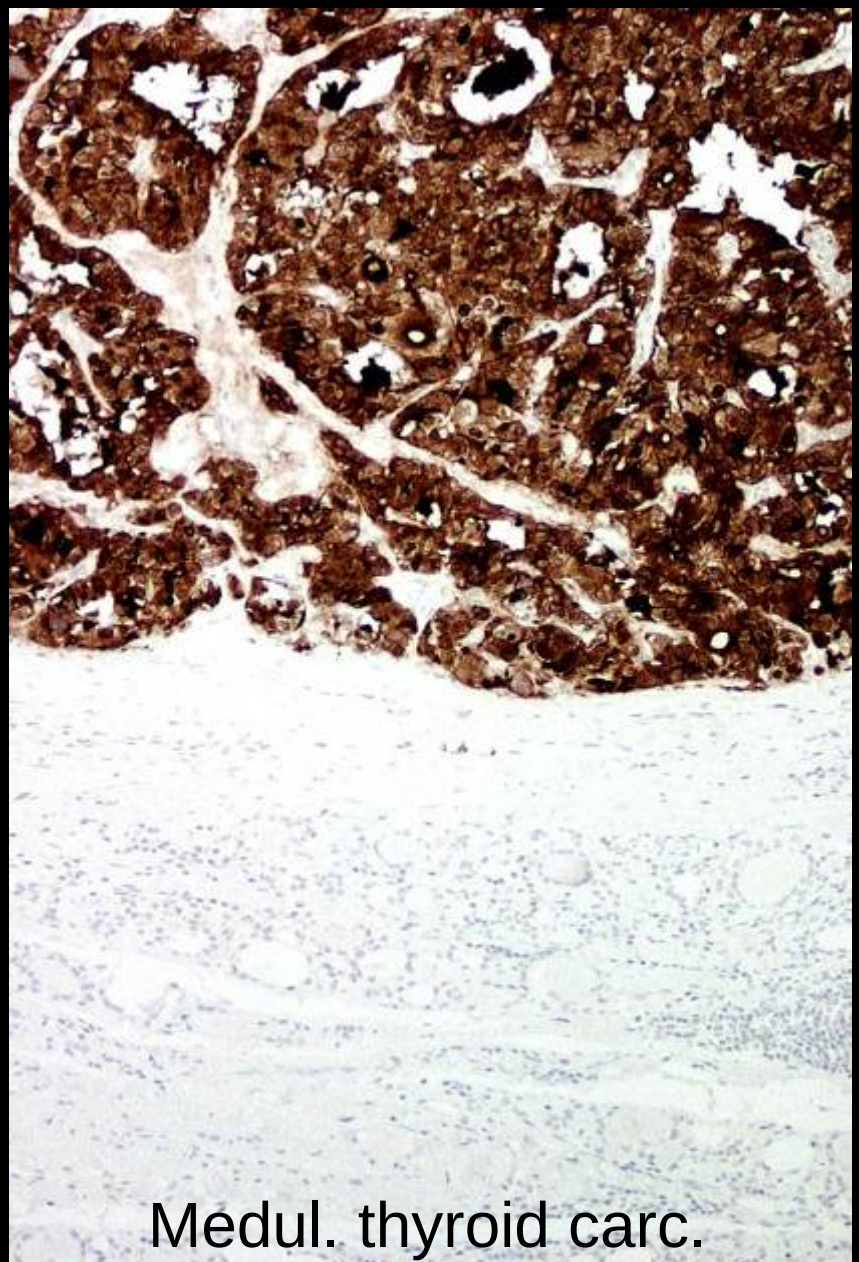
Carcinoembryonic antigen (CD66e) in adenocarcinomas

- Colorectal +
- Medull. thyroid +
- Pancreas/biliary tract +/–
- Stomach +/–
- Lung +/–
- Ovary, mucinous +/–
- Ovary, non-muc. –/+
- Prostate –
- Kidney –
- Liver (!) –
- Mesothelioma (!) –

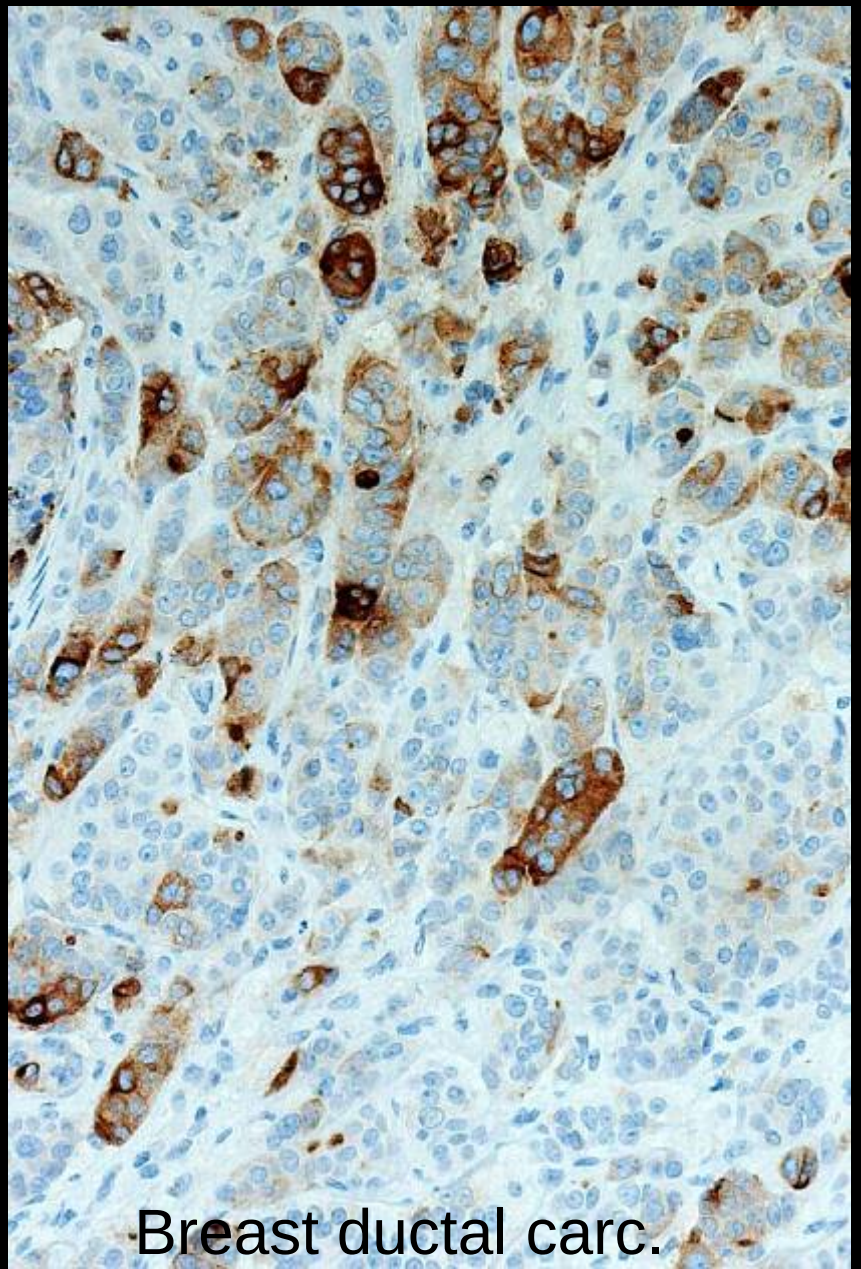


metast. colon adenoc

Carcinoembryonic antigen



Medul. thyroid carc.



Breast ductal carc.

Carcinoembryonic antigen – which antibody?

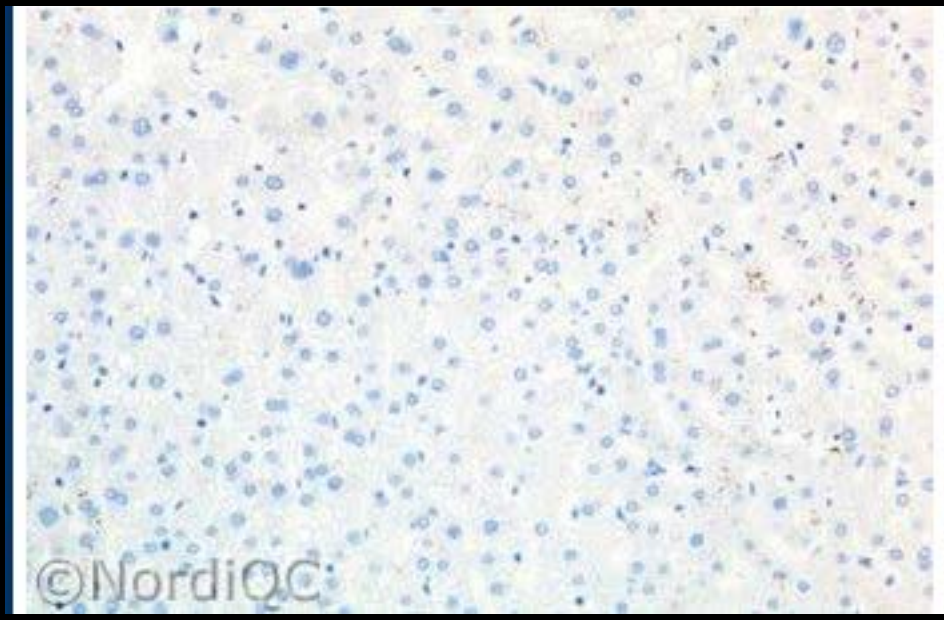
NordiQC assessment results

Table 1. Abs and assessment marks for CEA, run 27

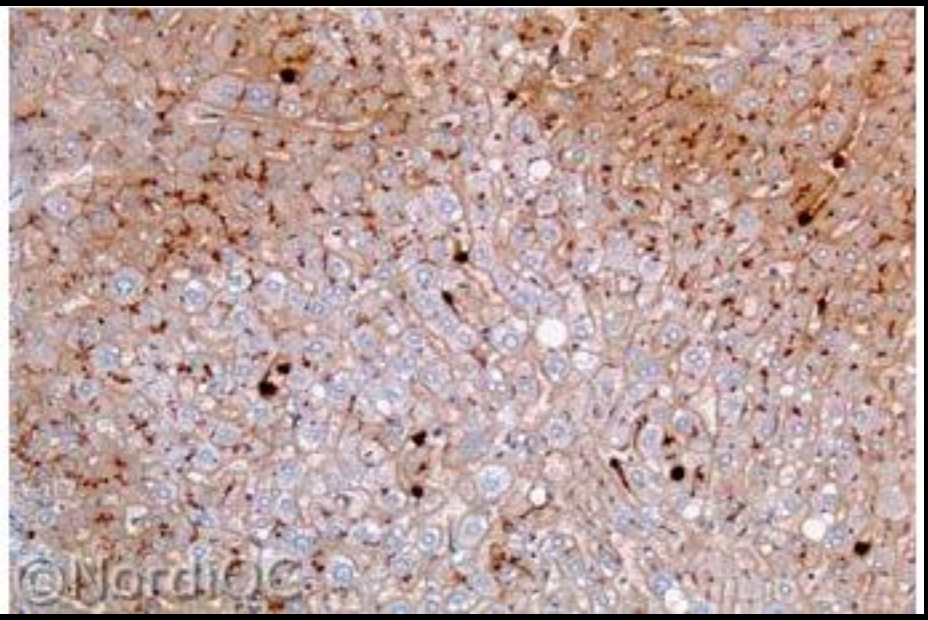
Concentrated Abs	N	Vendor	Optimal	Good	Borderl.	Poor	Suff.[1]	Suff. OPS[2]
mAb clone **II-7**	78	Dako	37	34	6	1	91 %	96 %
mAb clone **COL-1**	5 2 1 1 1	NeoMarkers Zymed Biocare Master Diagnostica Zytomed	6	2	2	0	80 %	100 %
mAb clone **12-140-10**	3 1	Novocastra Vector	0	0	1	3	-	-
mAb clone **PARLAM 4**	1 1	Bio-Science AG Euro Diagnostica	0	0	0	2	-	-
mAb clone **B01-94-11M-P**	1	BioGenex	0	0	0	1	-	-
mAb clone **TF3H8-1**	1	BioGenex	0	0	0	1	-	-
Ready-To-Use Abs								
mAb clone **II-7, IS622/IR622**	11	Dako	11	0	0	0	100 %	100 %
mAb clone **TF3H8-1, 760-2507**	13	Ventana	0	0	0	13	0 %	-

Carcinoembryonic antigen – which antibody?

Normal liver

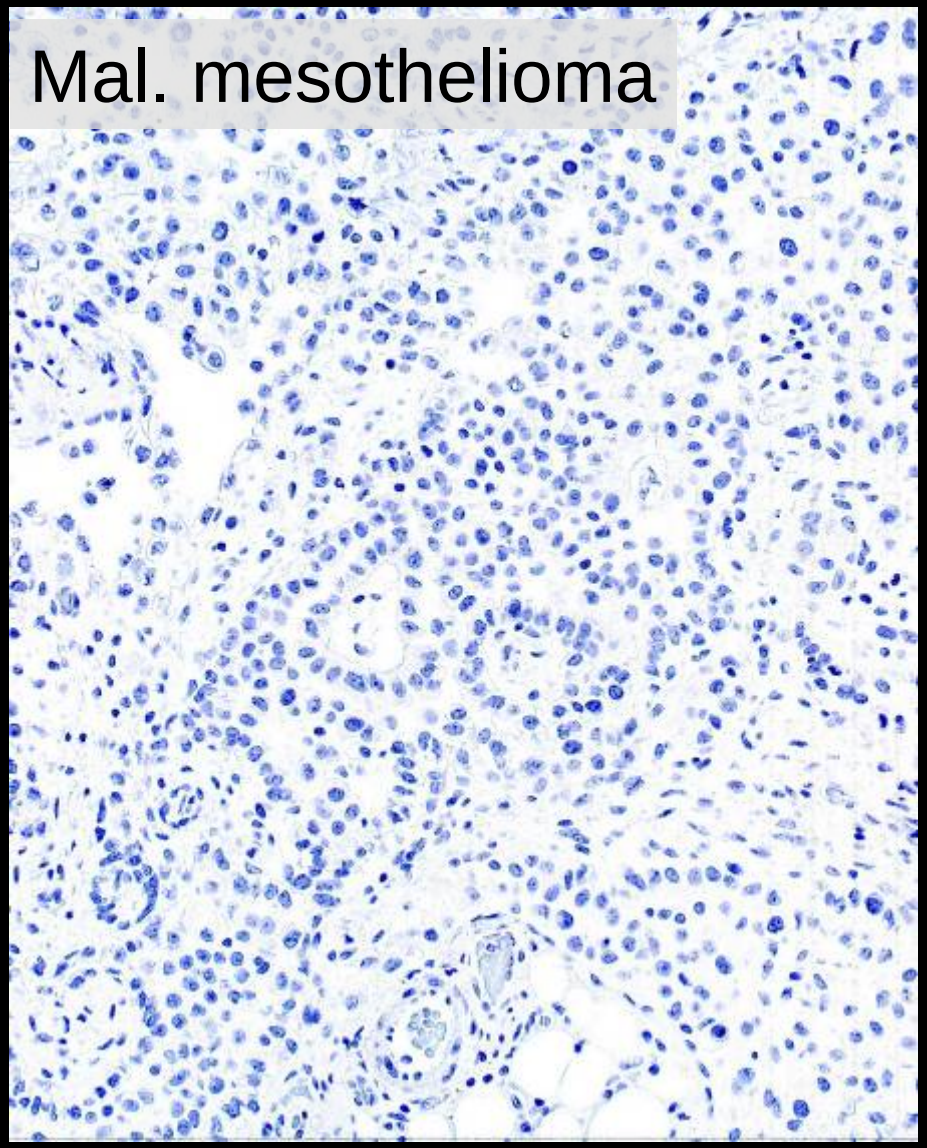


Clone II-7

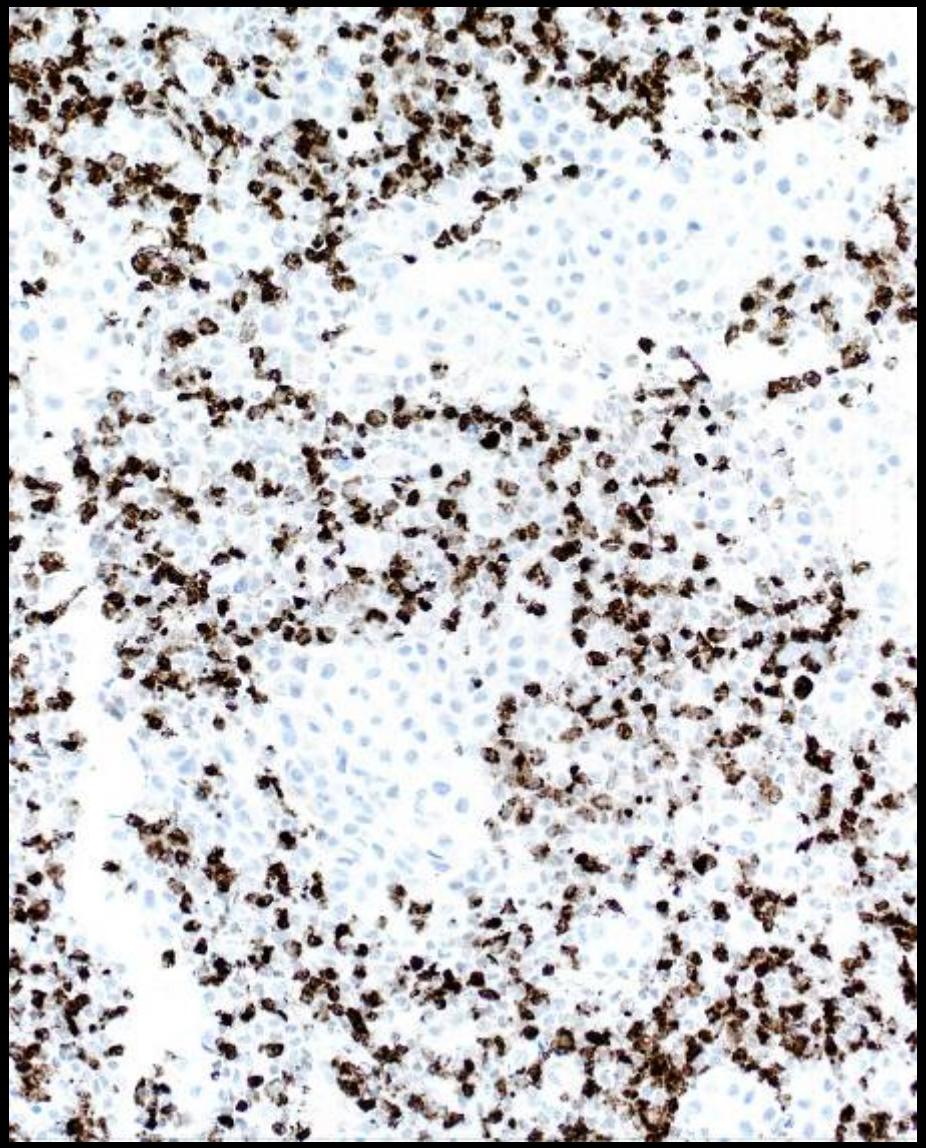


Clone TF3H8-1

Carcinoembryonic antigen – which antibody?

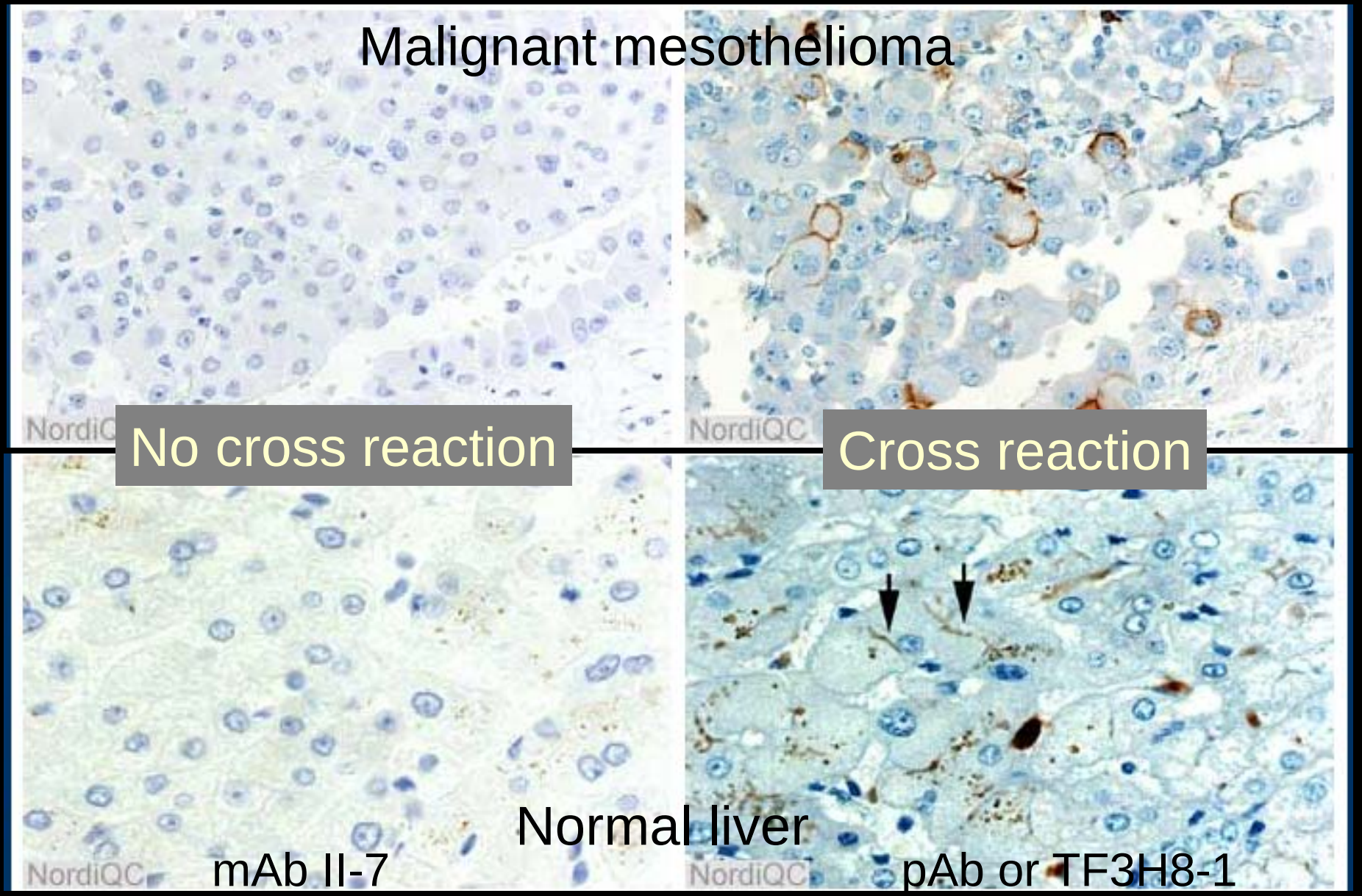


mAb II-7



pAb or TF3H8-1

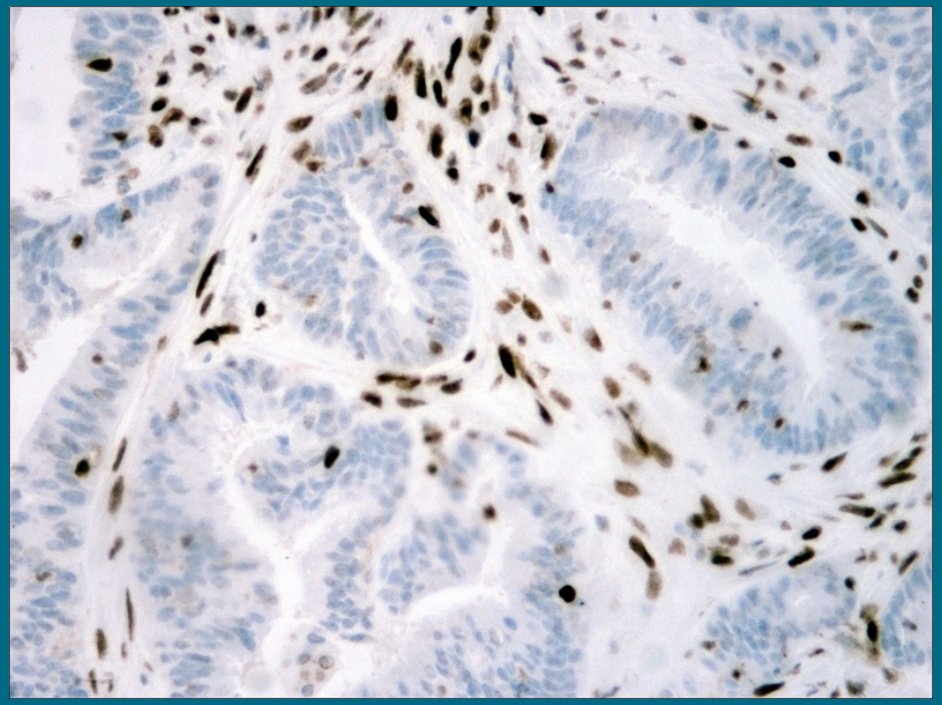
Carcinoembryonic antigen



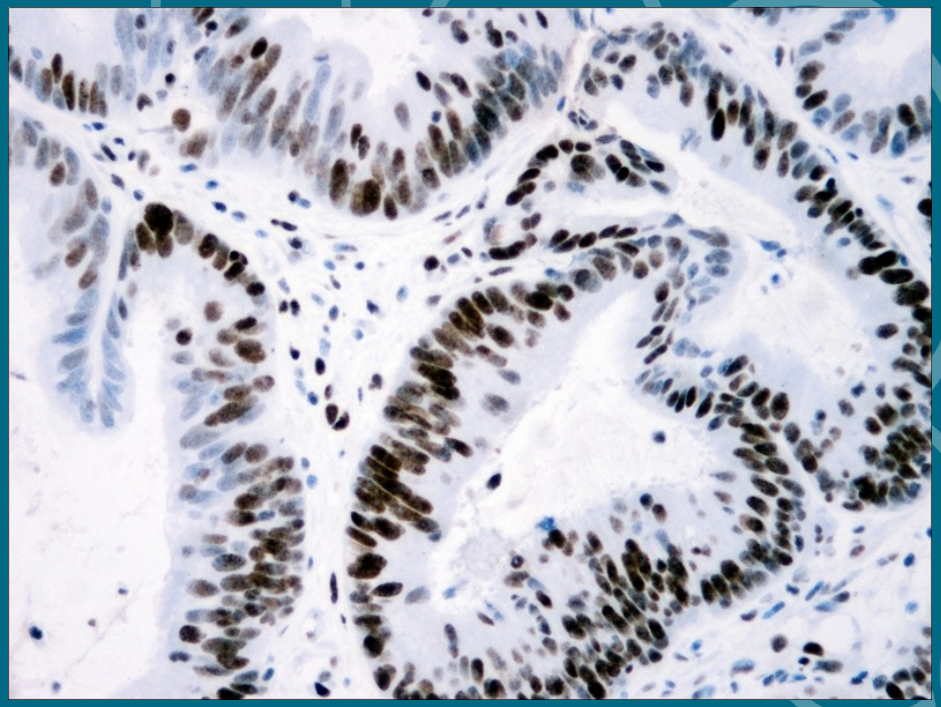
LYNCH SYNDROME

- Autosomal dominant germline mutation causing loss of a mismatch repair protein
- Found in 2-7% of colorectal and endometrial carcinomas
- Mutation in **MLH1** (~60%), **MSH2** (~30%), **MSH6** (~10%), **PMS2** (rare)
- Tumors develop at early age, usually found on right side
- Life time risk ~70%
- Synchronous and metachronous colorectal cancers: 40% develop within 10 years without total colonic resection

LYNCH SYNDROME



Deficient: dMMR



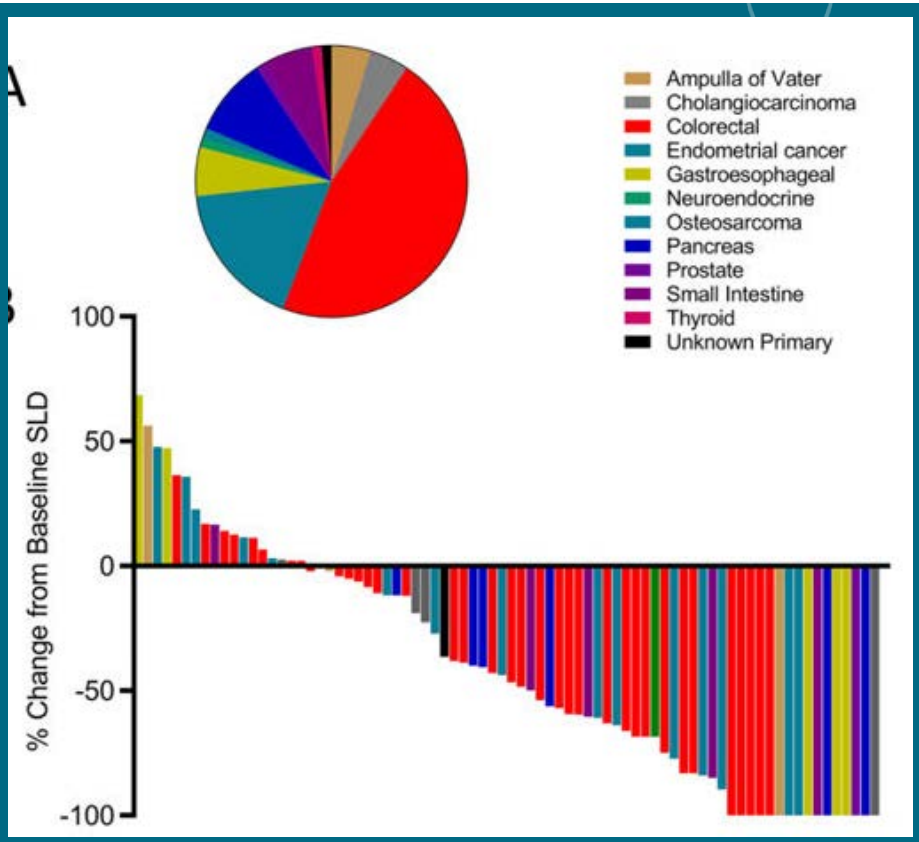
Proficient: pMMR

DNA mismatch repair proteins promotes genomic stability by correcting base-base and small insertion/deletion mispairs that arise during DNA replication and recombination

Published in final edited form as:
Science. 2017 July 28; 357(6349): 409–413. doi:10.1126/science.aan6733.

Mismatch-repair deficiency predicts response of solid tumors to PD-1 blockade

Dung T. Le[1,2,3], Jennifer N. Durham[1,2,3,*], Kellie N. Smith[1,3,*], Hao Wang[3,*], Bjarne R.



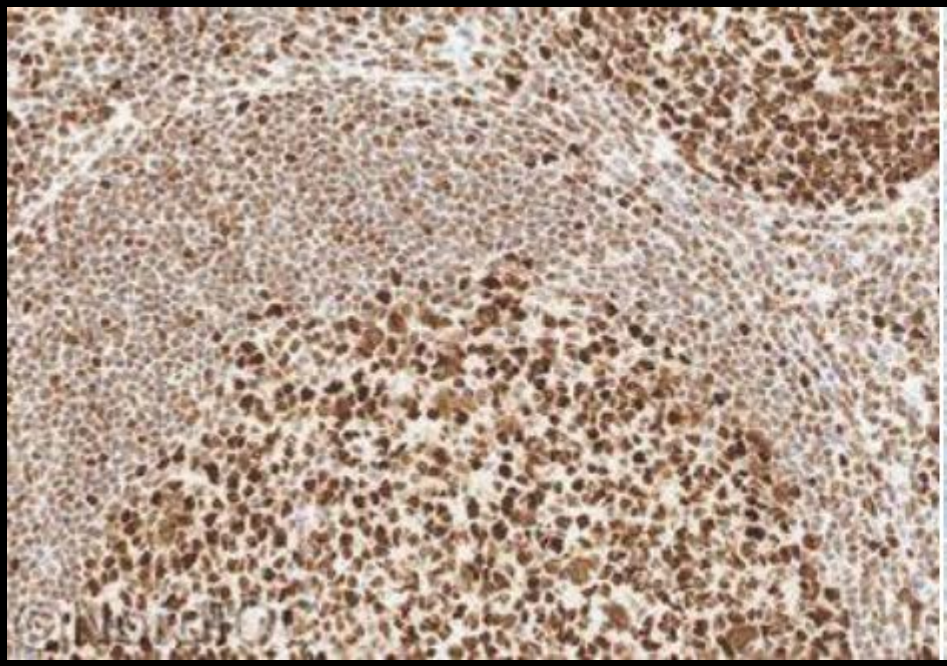
MLH1

Table 1. **Antibodies and assessment marks for MLH1, run 40.**

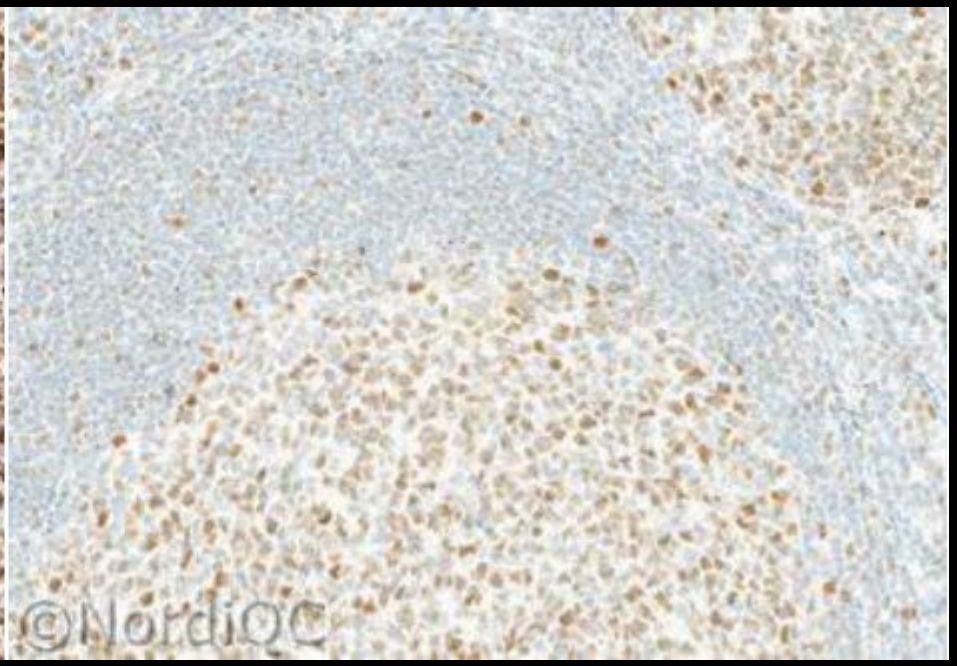
Concentrated antibodies	n	Vendor	Optimal	Good	Borderline	Poor	Suff.[1]	Suff. OPS[2]
mAb clone **4C9C7**	1	Thermo/Neomarkers	0	1	0	0	-	-
mAb clone **ES05**	28 7	Leica/Novocastra Dako	18	11	3	3	83%	90%
mAb clone **G168-15**	17 6 2	BD Pharmingen Biocare Zytomed	6	8	8	3	56%	82%
mAb clone **G168-728**	2 2 1	Cell Marque Zeta Corp BioSB	0	0	2	3	-	-
Ready-To-Use antibodies								
mAb clone **ES05 IR079**	27	Dako	18	5	3	1	85%	92%
mAb clone **ES05 PA0610**	3	Leica/Novocastra	2	1	0	0	-	-
mAb clone **ES05 ZM-0154**	1	Zhonggshan	0	0	1	0	-	-
mAb clone **G168-15 PM220**	3	Biocare	1	2	0	0	-	-
mAb clone **G168-15 PDM 148**	2	Diagnostic Biosystems	1	0	1	0	-	-
mAb clone **G168-728 760-4264**	3	Ventana/Cell Marque	0	0	3	0	-	-
mAb clone **G168-728 MAD-000372QD**	1	Master Diagnostica	1	0	0	0	-	-
mAb clone **M1 760-4535**	36	Ventana	15	13	8	0	78%	77%
Total	142		62	41	29	10	-	
Proportion			44%	29%	20%	7%	73%	

MLH1

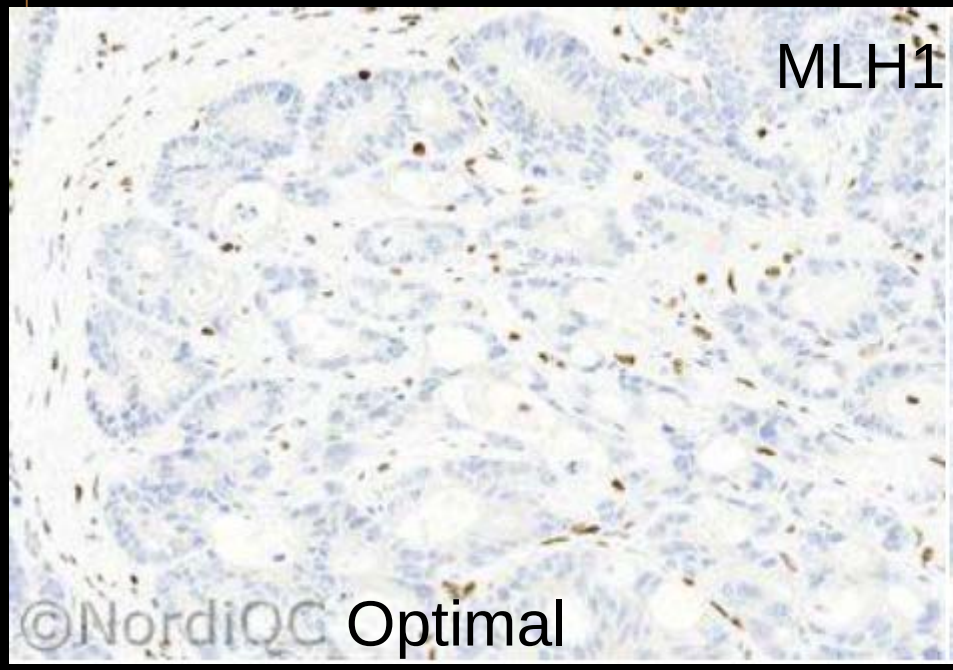
- Improper calibration of Ab titre
- Less sensitive detection system
- Less succesful Ab clone G168-728 (8/9 insuff.)

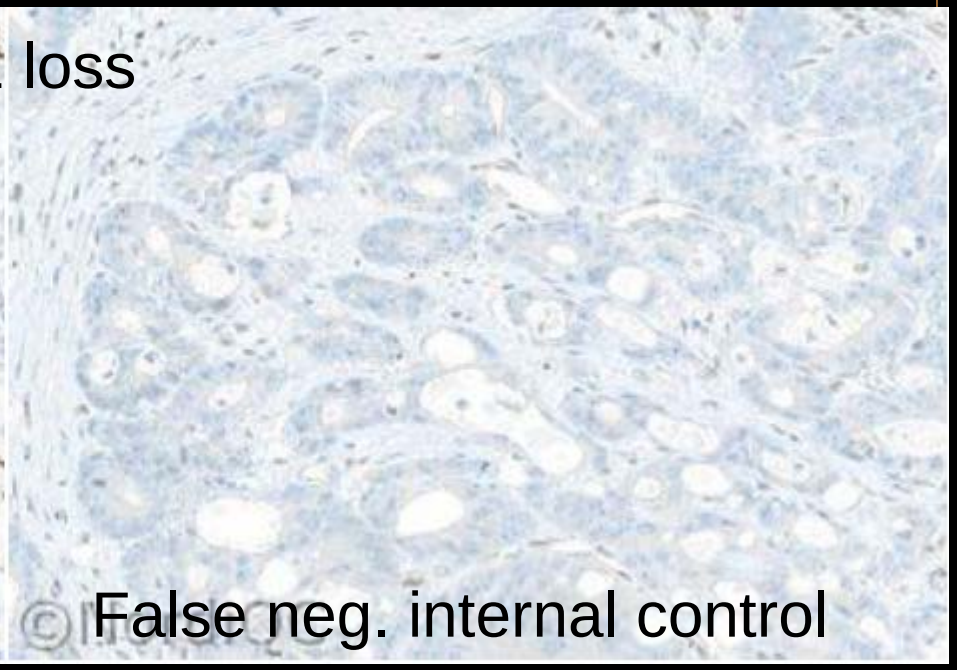


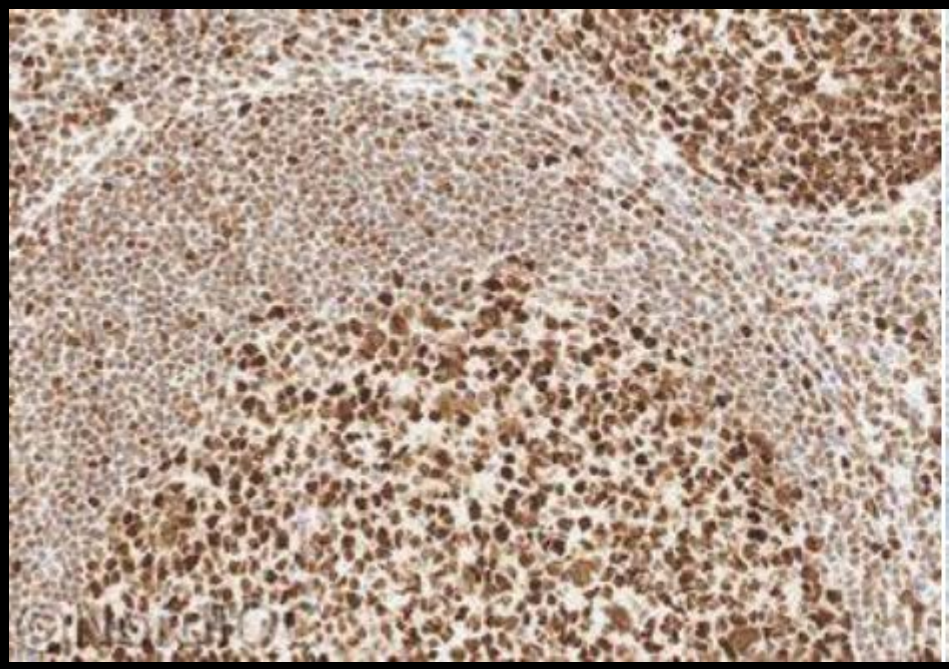
3-step polymer

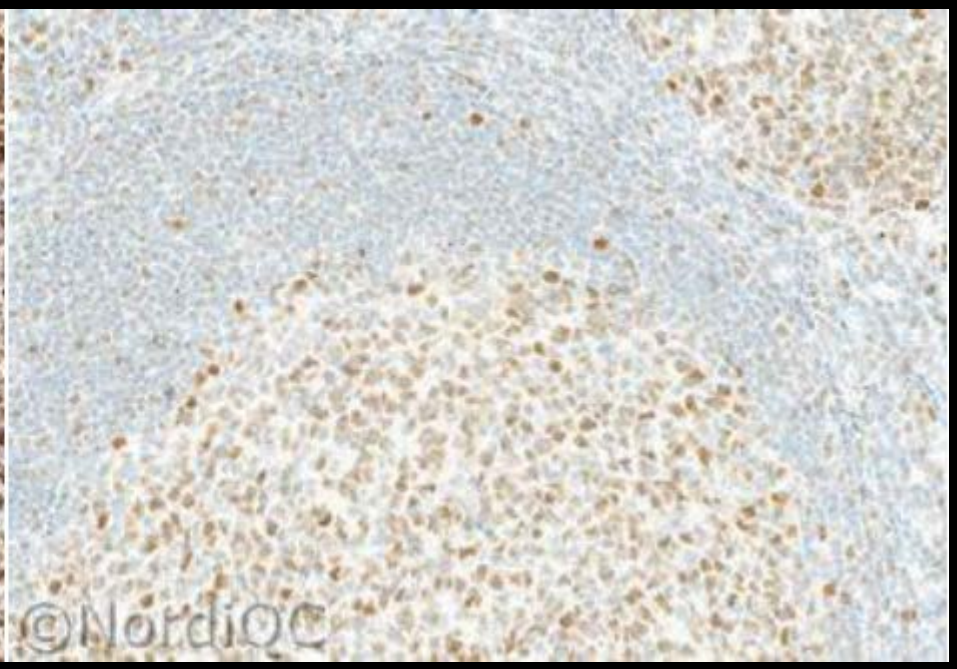


2-step polymer


MLH1 loss
©NordiQC
Optimal

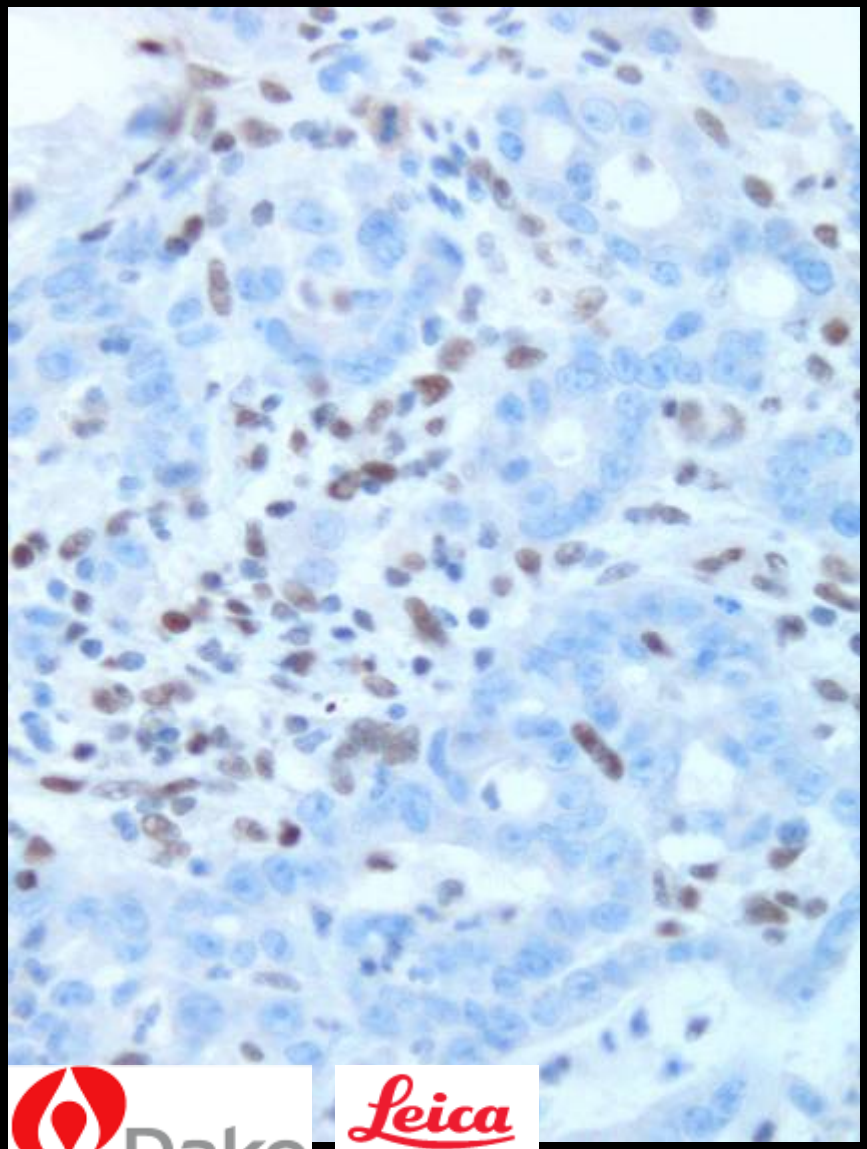

©NordiQC
False neg. internal control


©NordiQC
3-step polymer

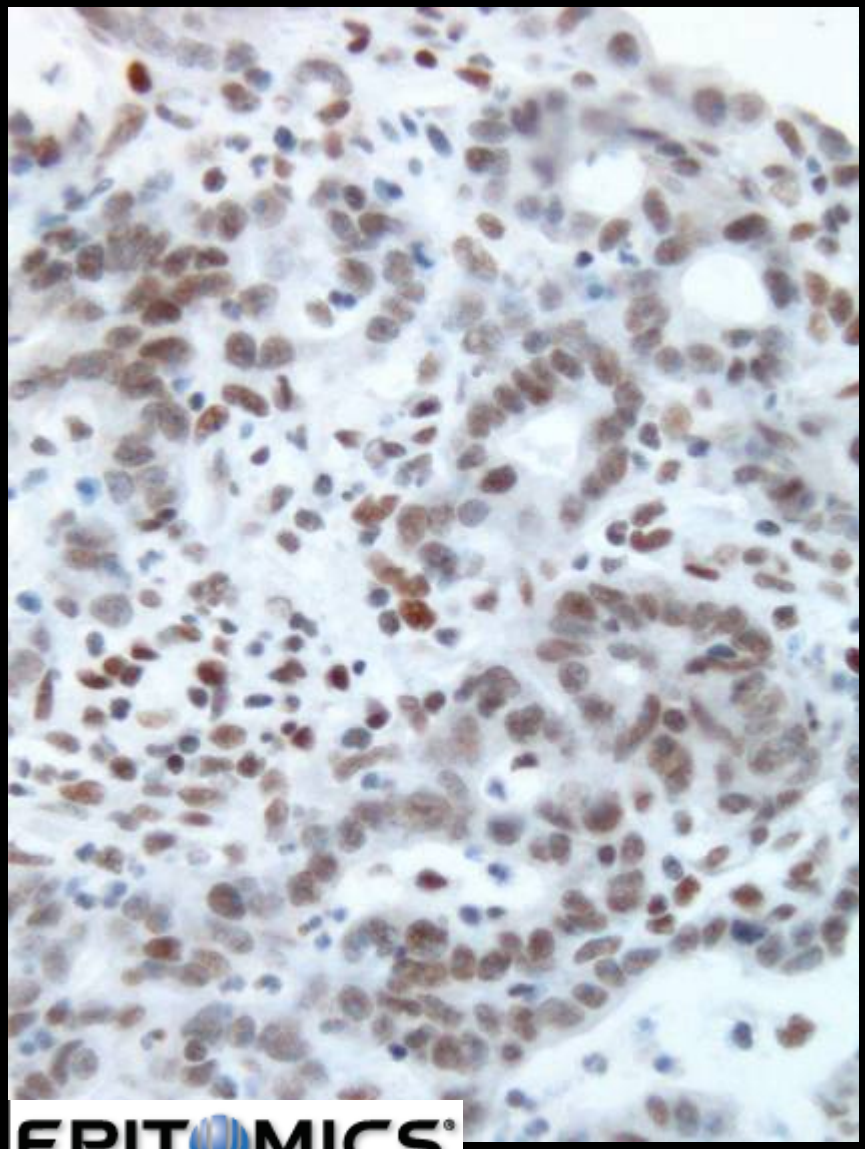

©NordiQC
2-step polymer

Poor antibodies – MLH1

MLH1 clone ES05



MLH1 clone EPR3894



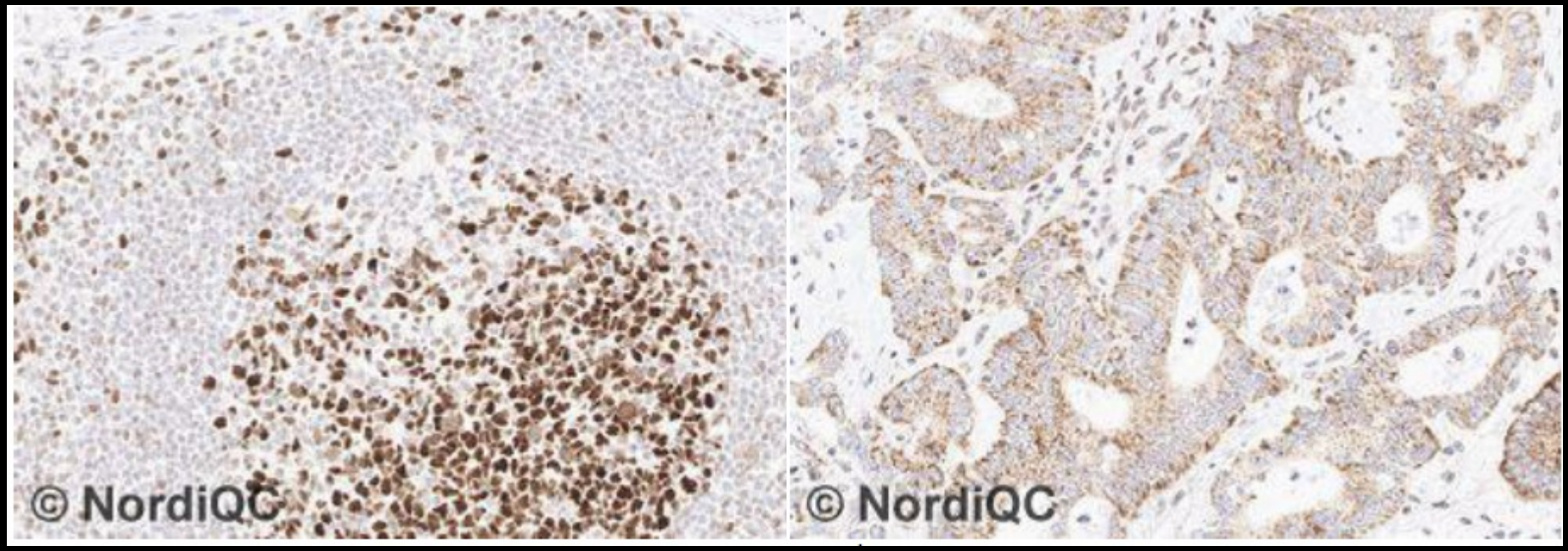
MSH2

Table 1. **Antibodies and assessment marks for MSH2, run 41**

Concentrated antibodies	n	Vendor	Optimal	Good	Borderline	Poor	Suff.[1]	Suff. OPS[2]
mAb clone **25D12**	12 1 1	Leica/Novocastra Diagnostic BioSystems Thermo/NeoMarkers	0	0	12	2	-	-
mAb clone **FE11**	10 6 6	Biocare Dako Millipore/Calbiochem	3	10	9	0	59%	80%
mAb clone **G219-1129**	11 8 1	BD Biosciences Cell Marque Monosan	4	6	6	4	50%	90%
mAb clone **GB12**	1	Millipore/Calbiochem	0	0	1	0	-	-
Ready-To-Use antibodies								
mAb clone **25D12 PA0048**	3	Leica/Novocastra	0	0	3	0	-	-
mAb clone **FE11 IR085**	23	Dako	20	2	1	0	96%	100%
mAb clone **FE11 PM219**	2	Biocare	0	2	0	0	-	-
mAb clone **FE11 MSG031**	1	Zytomed	1	0	0	0	-	-
mAb clone **G219-1129 760-4265**	50	Ventana/Cell Marque	26	19	3	2	90%	93%
mAb clone **G219-1129 286M-18**	5	Cell Marque	2	1	2	0	60%	-
mAb clone **G219-1129 MAD-000371QD**	2	Master Diagnostica	0	0	2	0	-	-
Total	143		56	40	39	8	-	
Proportion			39%	28%	27%	6%	67%	

MSH2

- Improper calibration of Ab titre
- Insufficient HIER
- Poor Ab clone 25D12 (17/17 insuff.)



25D12 – combined false negative and false positive

“Liver cell markers”

Alpha fetoprotein

Hepatocyte antigen (Heppar1)

Arginase

Glypican 3

canCD66a (biliary glycoprotein)

canCD10

canVillin

Glutamine synthetase 6

- AFP (alpha-fetoprotein)

Fetal counterpart of albumin (transporter)

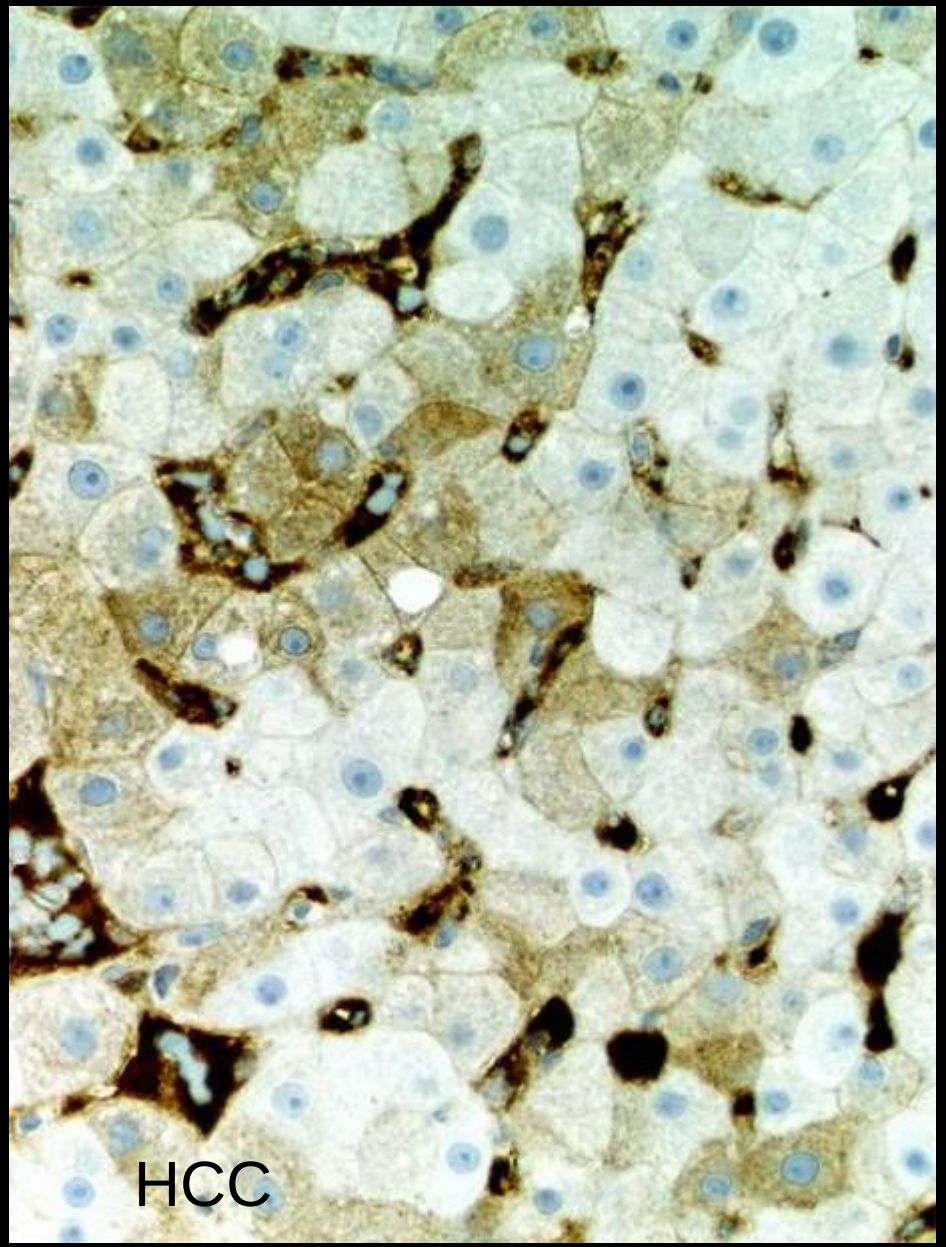
- Fetal yolk sac
- Fetal liver and GI tract

Neoplasms:

Yolk sac tumour +

Hepatocell.carc. –/+

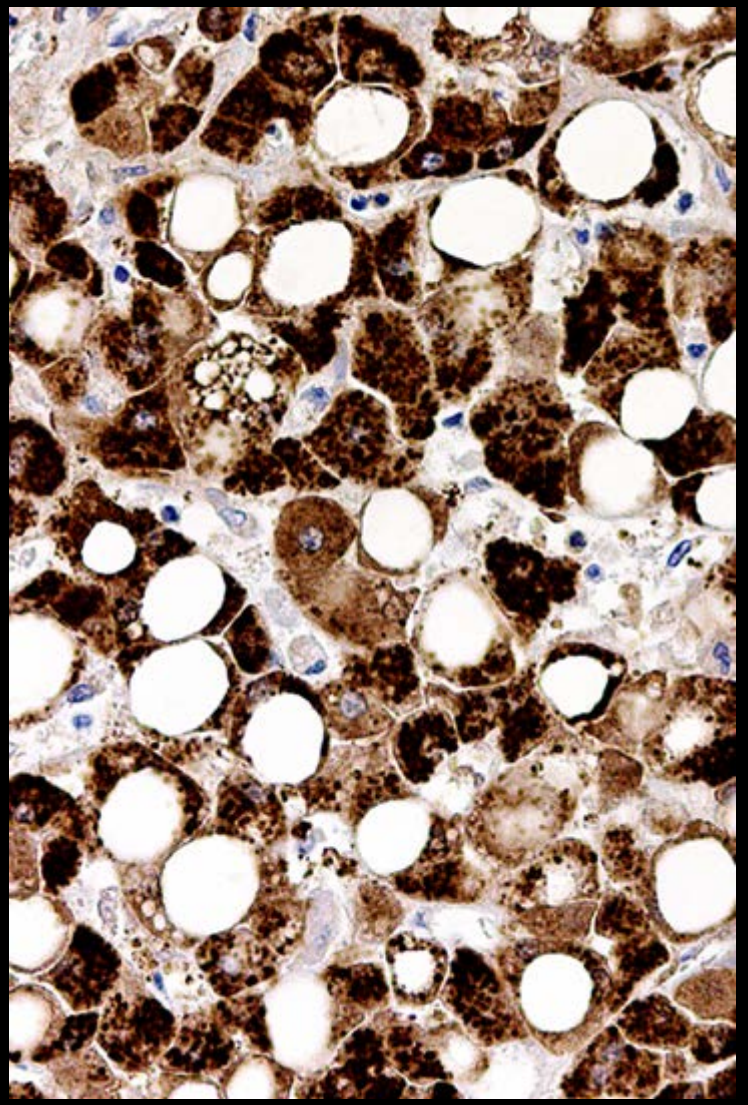
Other carc. –(+)



Hepatocyte Antigen

Intra-mitochondrial epitope:
carbamoyl phosphate synthetase 1,
a rate-limiting enzyme of urea cycle

- Liver cells
- Small intestine enterocytes

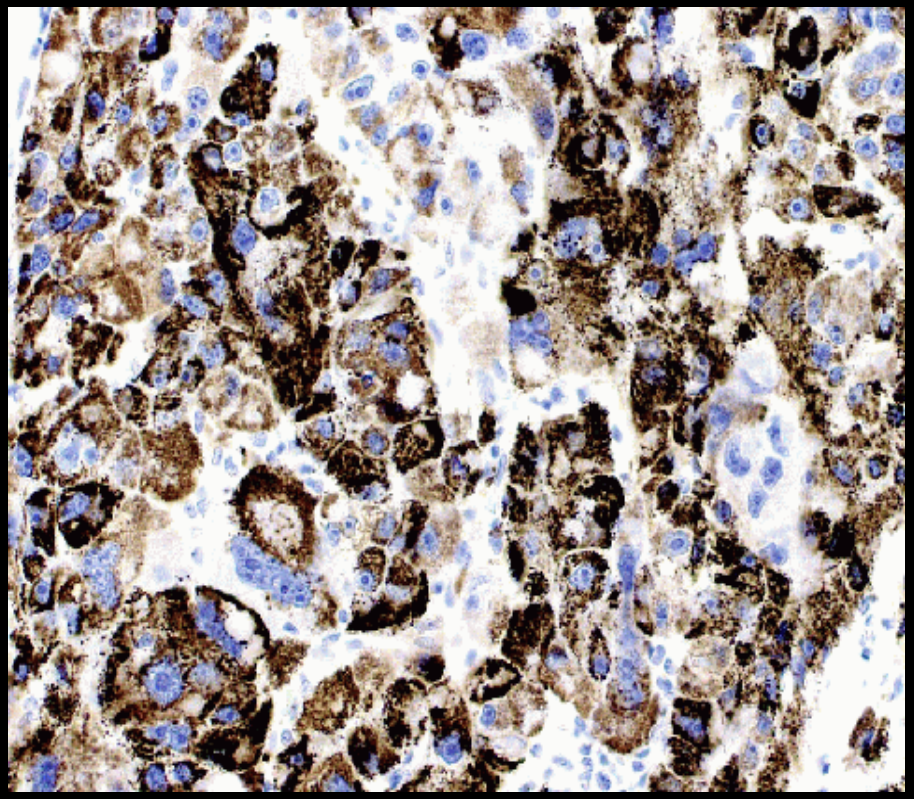


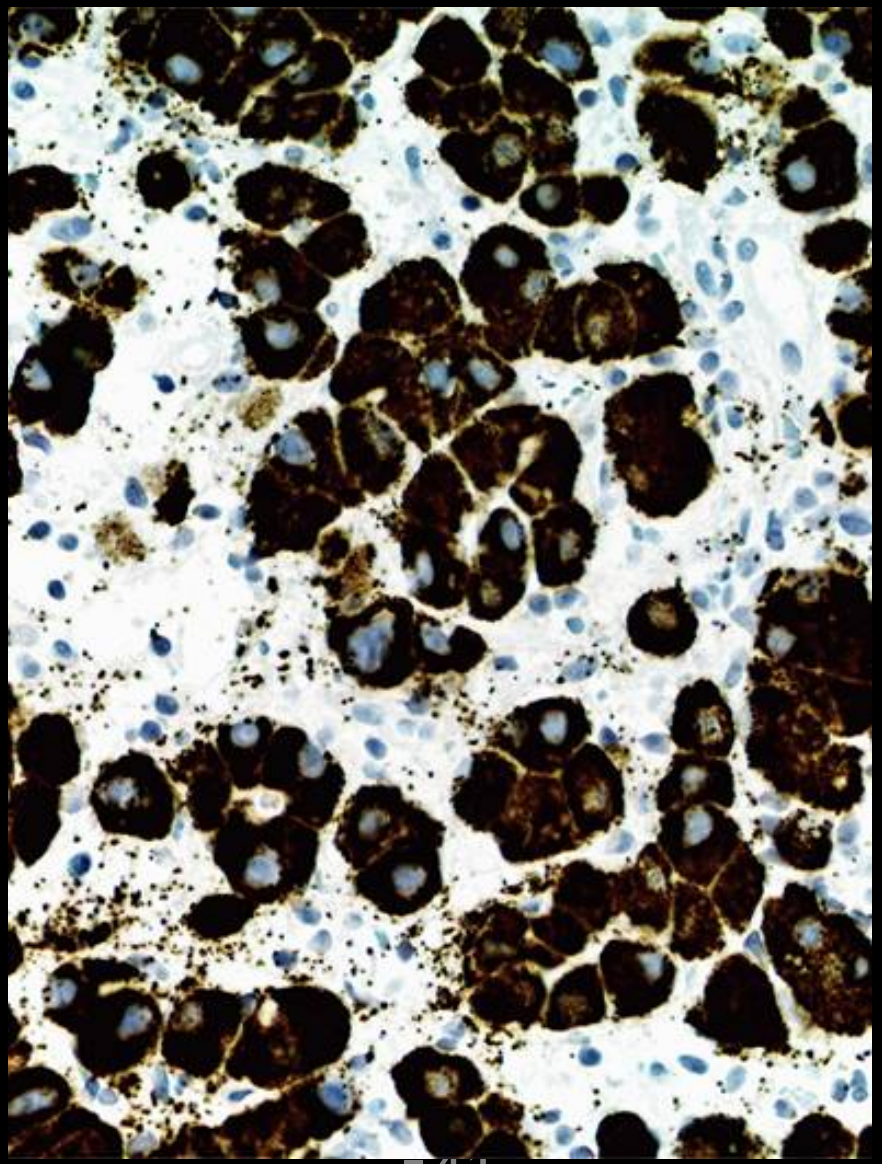
- Hepatocyte Antigen

Hepatocellular carc. 80%

Intestinal adenocarc.

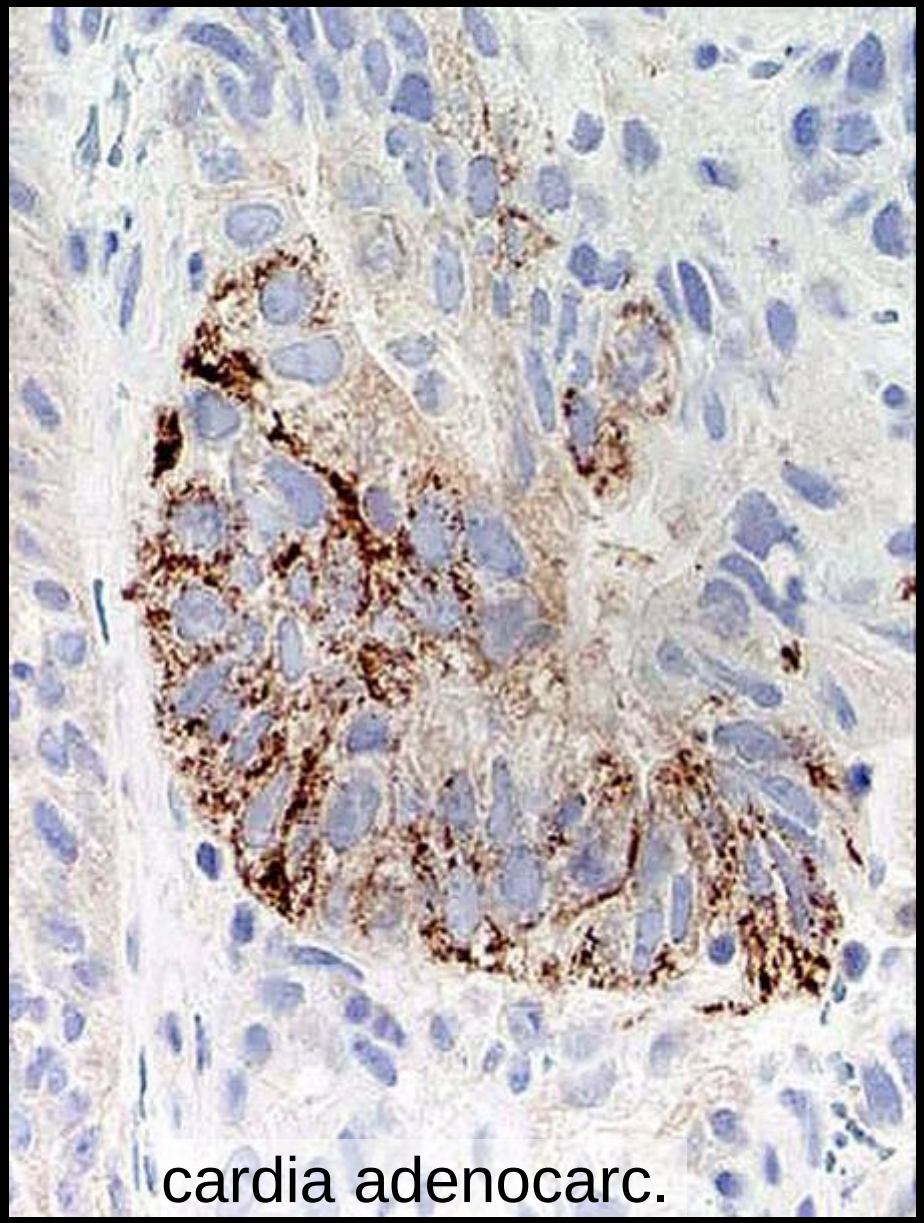
- 15- 50%



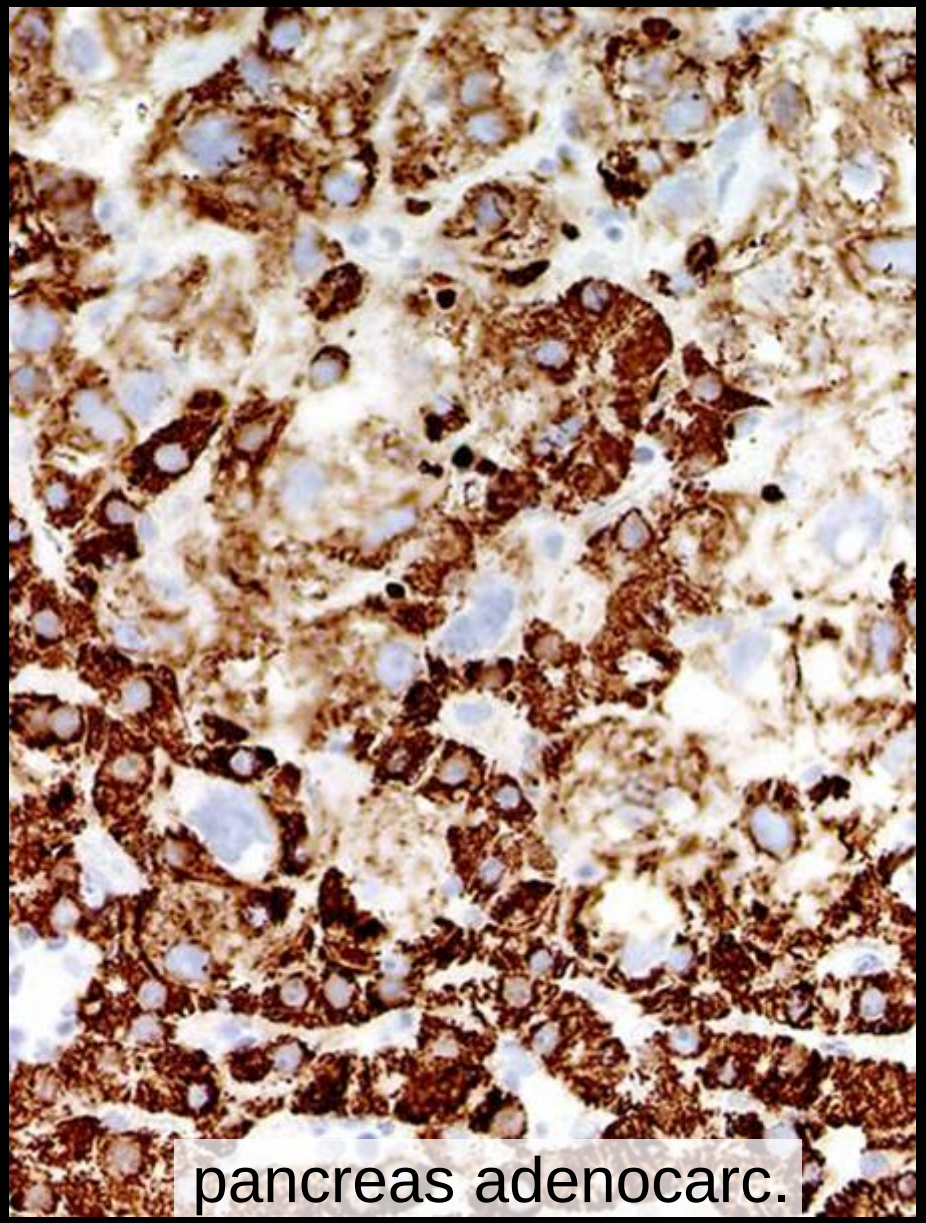


Hep Par 1: HCC

Hepatocyte Antigen



cardia adenocarc.



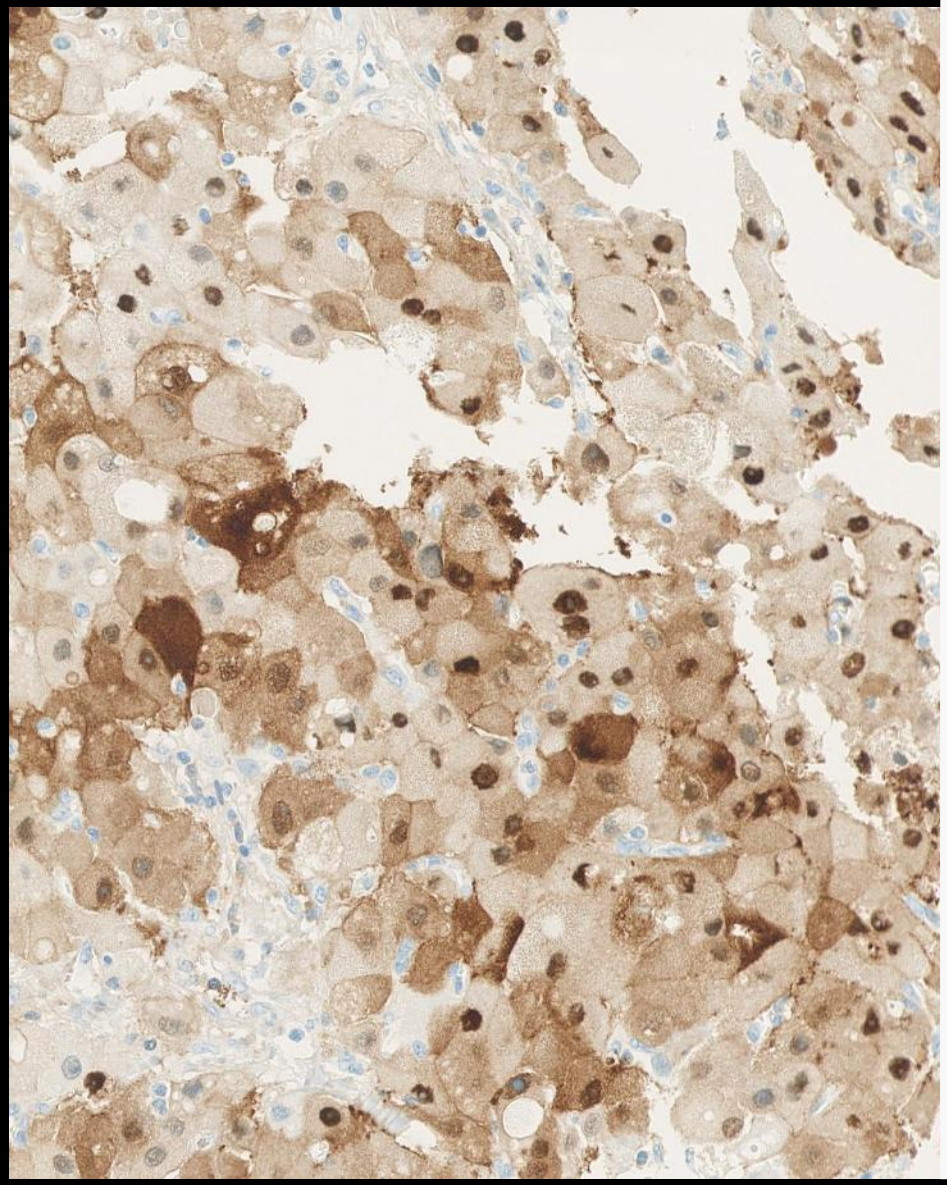
pancreas adenocarc.

Arginase I

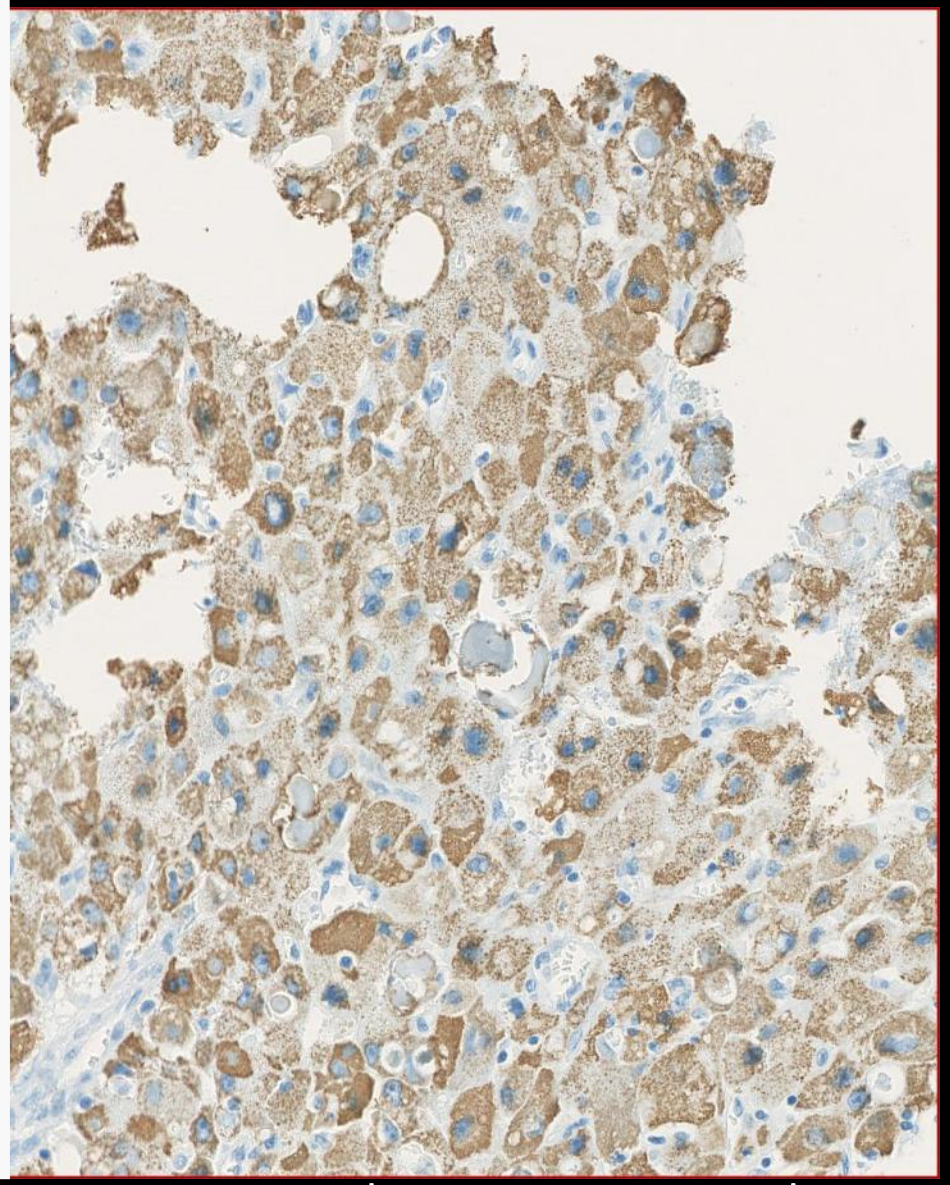
The final enzyme of the urea cycle:
arginine + $H_2O \rightarrow$ ornithine + urea

- Predominantly located in liver cells
- Hepatocellular carcinoma +/– (80-90%)
- Adenocarcinoma, biliary tract, pancreas –/+
- Adencarcinoma breast, colorectum –(+)

Arginase and hepatocyt antigen in hepatocellular carcinoma

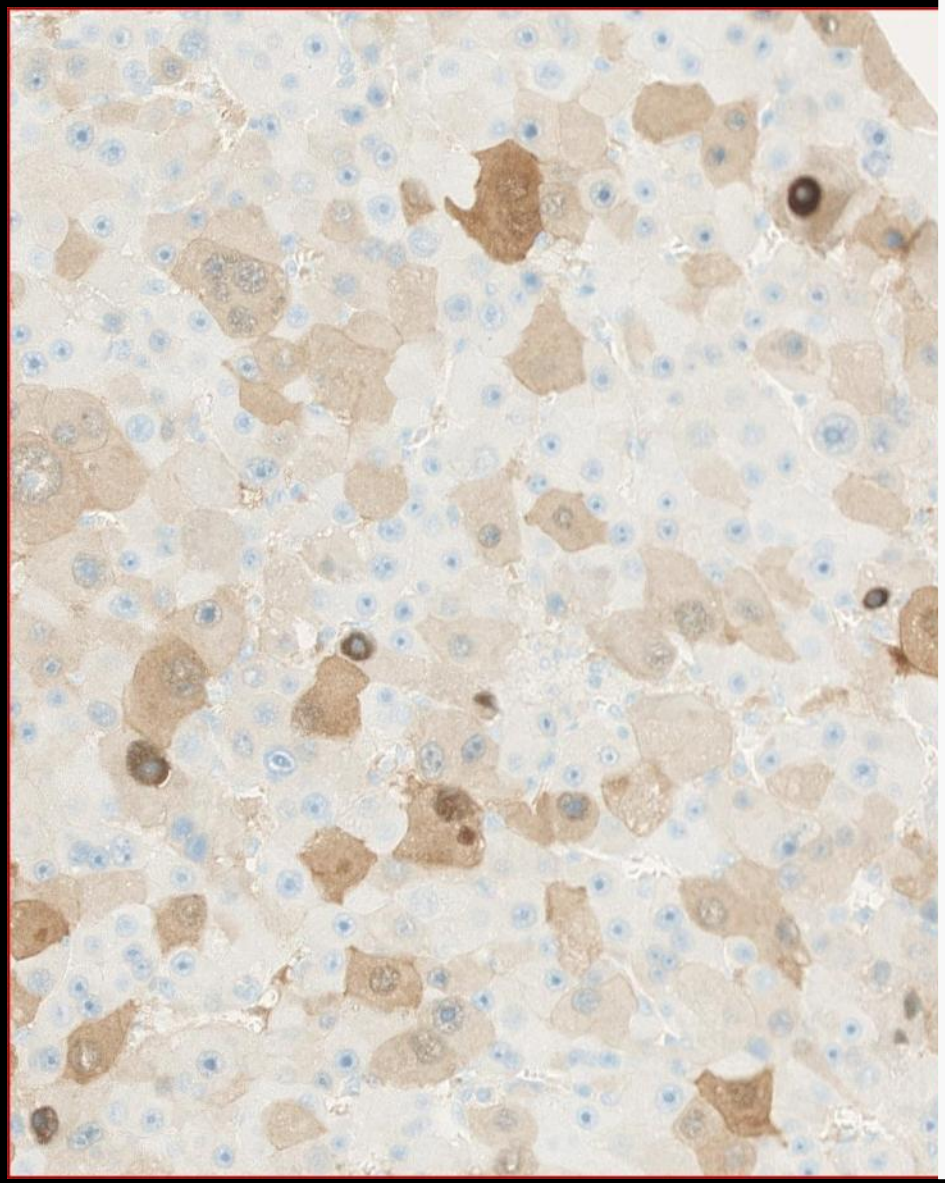


ARG: rmAb SP156 1:25 CM
16M/CC1S/UV

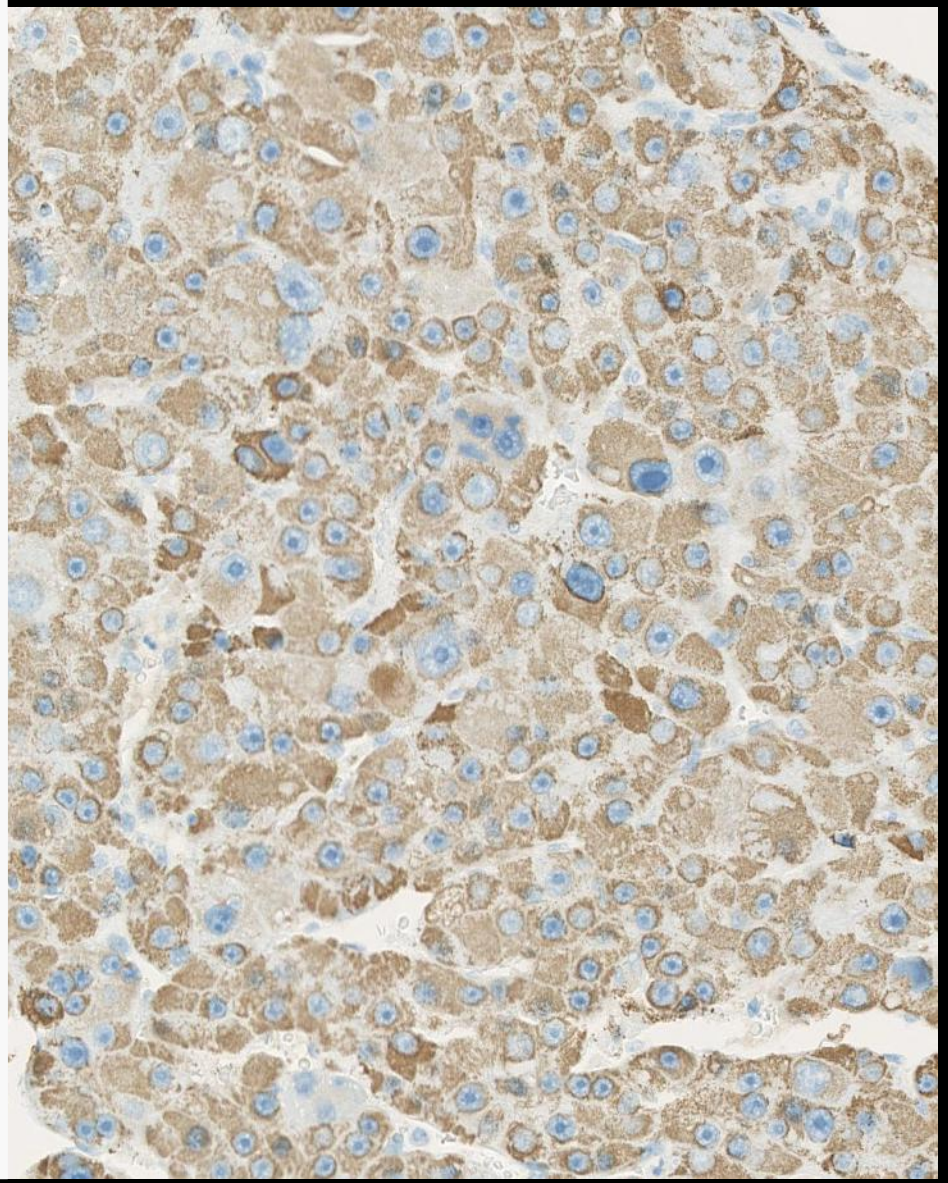


HEP: mAb OCH1E5 1:400 Dako
32M/CC1S/UV+amp

Arginase and hepatocyt antigen in hepatocellular carcinoma

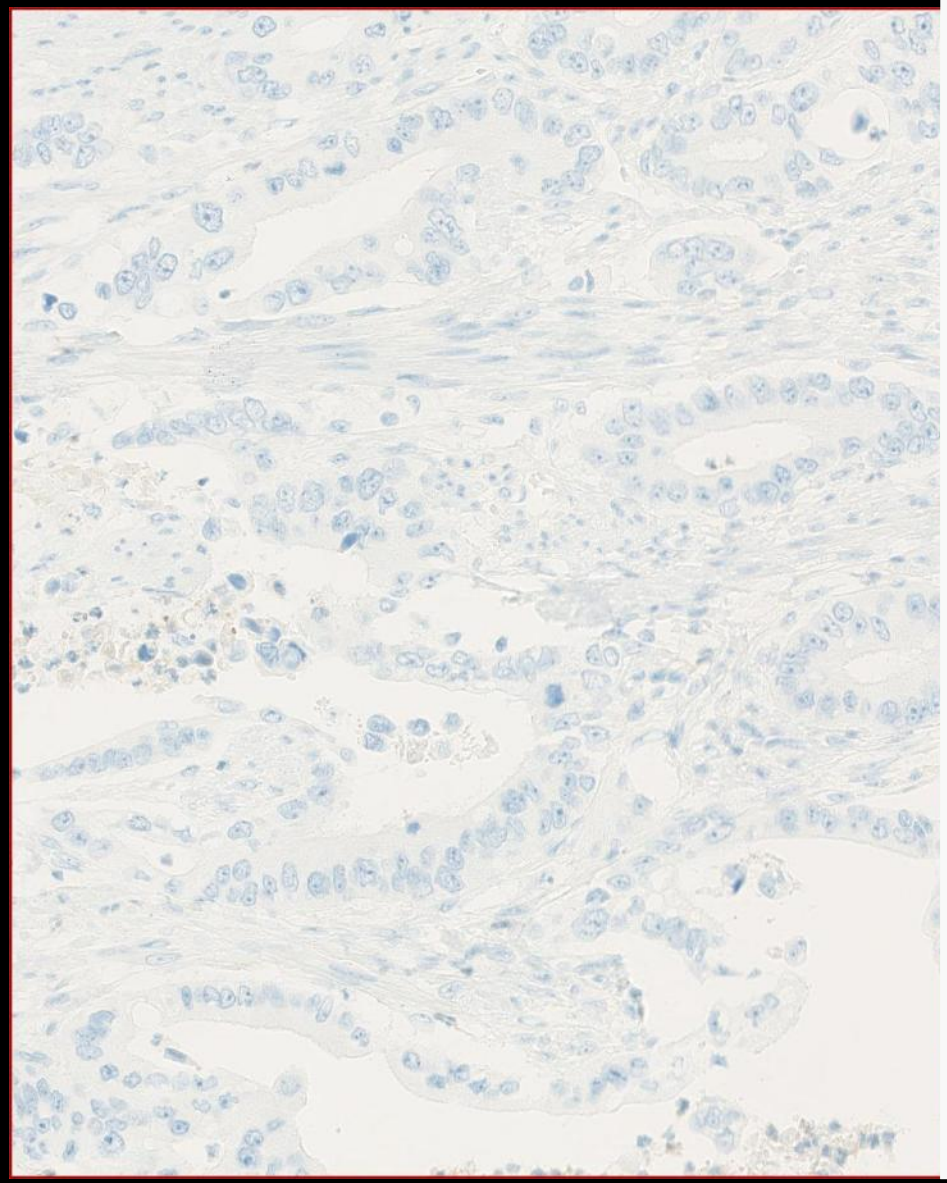


ARG: rmAb SP156 1:25 CM
16M/CC1S/UV

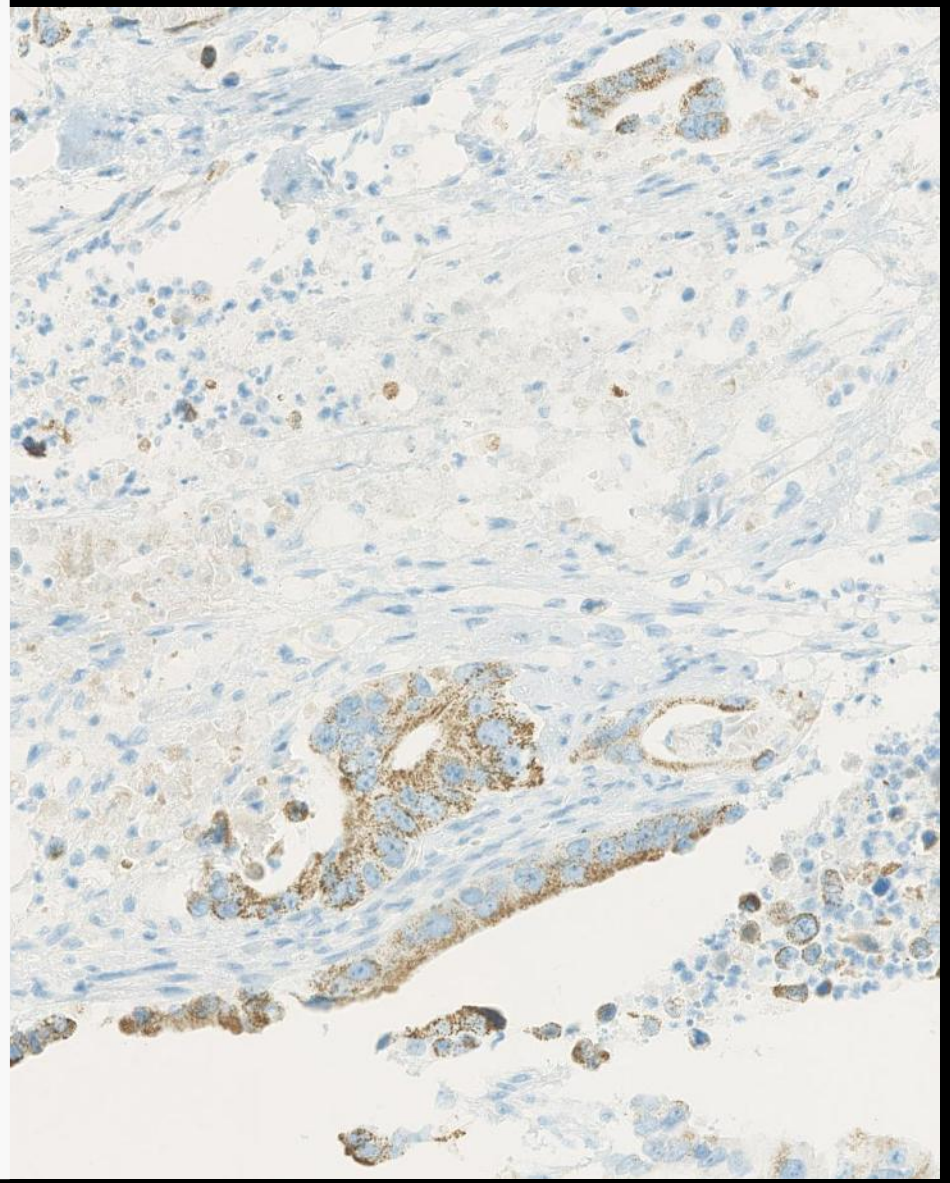


HEP: mAb OCH1E5 1:400 Dako
32M/CC1S/UV+amp

Arg and Hepa – Pancreas adenocarcinoma



rmAb SP156 1:25 CM
16M/CC1S/UV

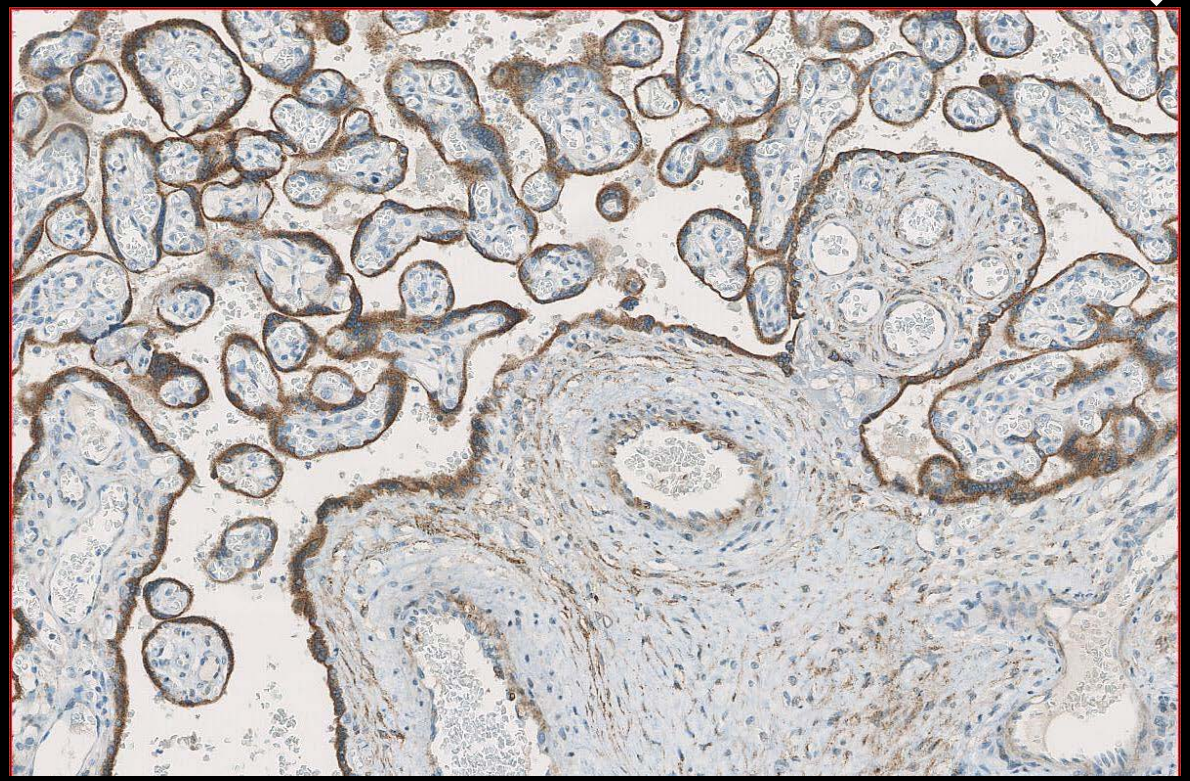


mAb OCH1E5 1:400 Dako
32M/CC1S/UV+amp

Glypican 3

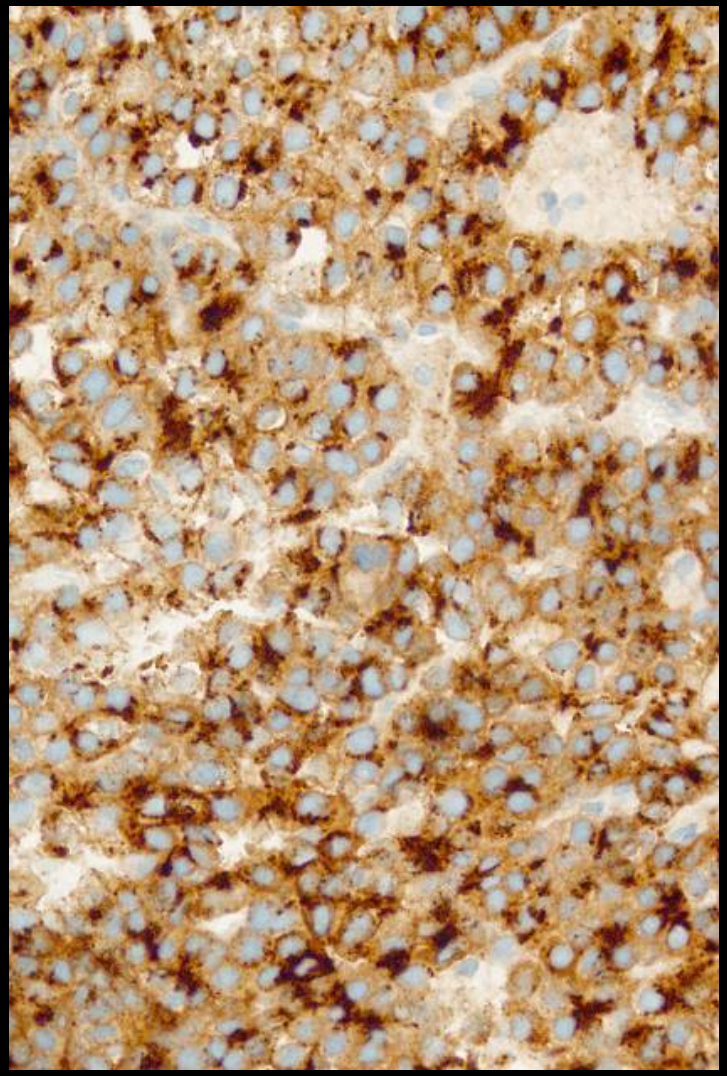
Cell surface heparan sulphate proteoglycan regulating cell growth and differentiation.

In normal tissues largely restricted to embryonic and foetal tissue and placental syncytiotrophoblast ⇩



Glypican 3

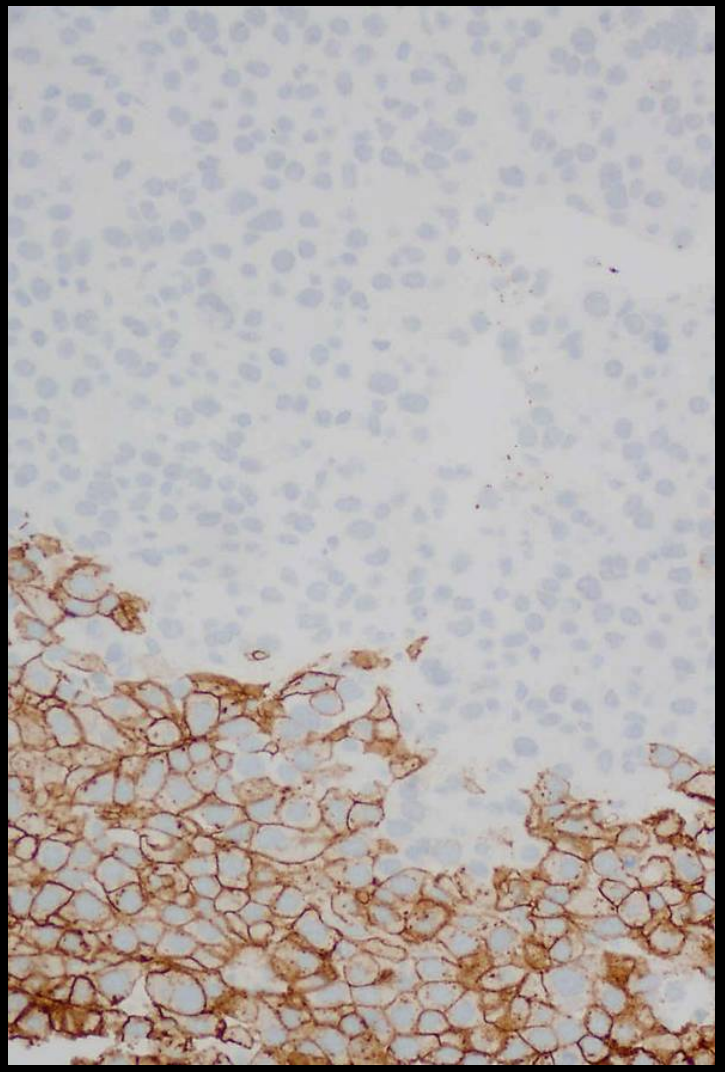
- Hepatocellular carcinoma +/-
- Yolk sac tumour +
- Chorionic carcinoma +
- Emb. carcinoma –(+)
- Colorectal adenocarcinoma +/-
- Gastric adenocarcinoma -/+
- Merkel cell carcinoma +/-
- Ovarian clear cell carcinoma -/+
- Ovarian serous carcinoma –(+)
- Liposarcoma +/-



HCC

Glypican 3

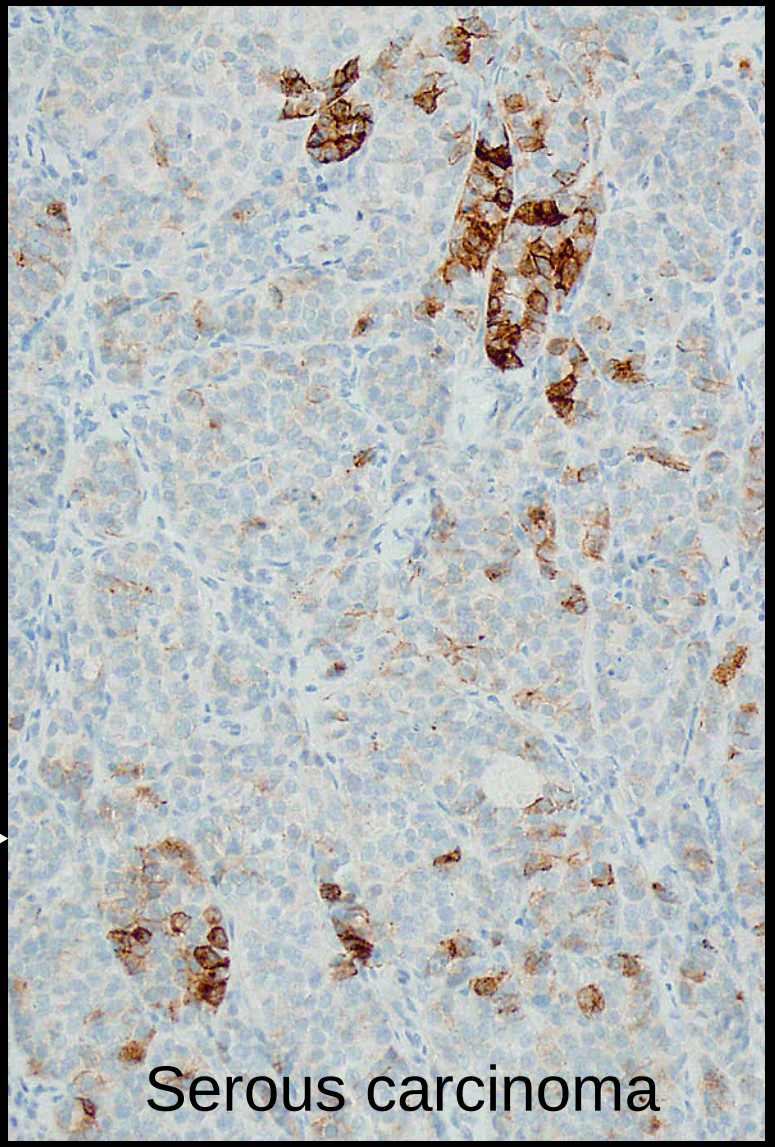
- Hepatocellular carcinoma +/-
- Yolk sac tumour +
- Chorionic carcinoma +
- Emb. carcinoma –(+)
- Colorectal adenocarcinoma +/-
- Gastric adenocarcinoma -/+
- Merkel cell carcinoma +/-
- Ovarian clear cell carcinoma -/+
- Ovarian serous carcinoma –(+)
- Liposarcoma +/-



HCC

Glypican 3

- Hepatocellular carcinoma +/-
- Yolk sac tumour +
- Chorionic carcinoma +
- Emb. carcinoma –(+)
- Colorectal adenocarcinoma +/-
- Gastric adenocarcinoma -/+
- Merkel cell carcinoma +/-
- Ovarian clear cell carcinoma -/+
- Ovarian serous carcinoma –(+)
- Liposarcoma +/-

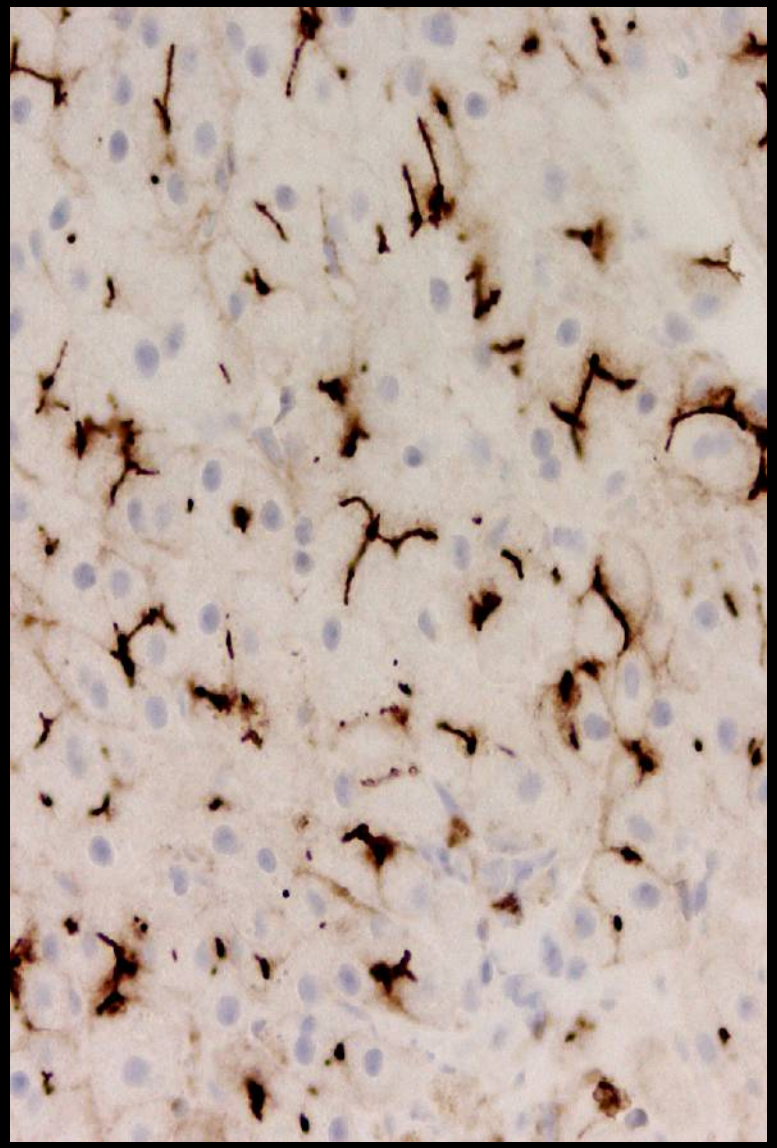


canCD66a (biliary glycoprotein-1)

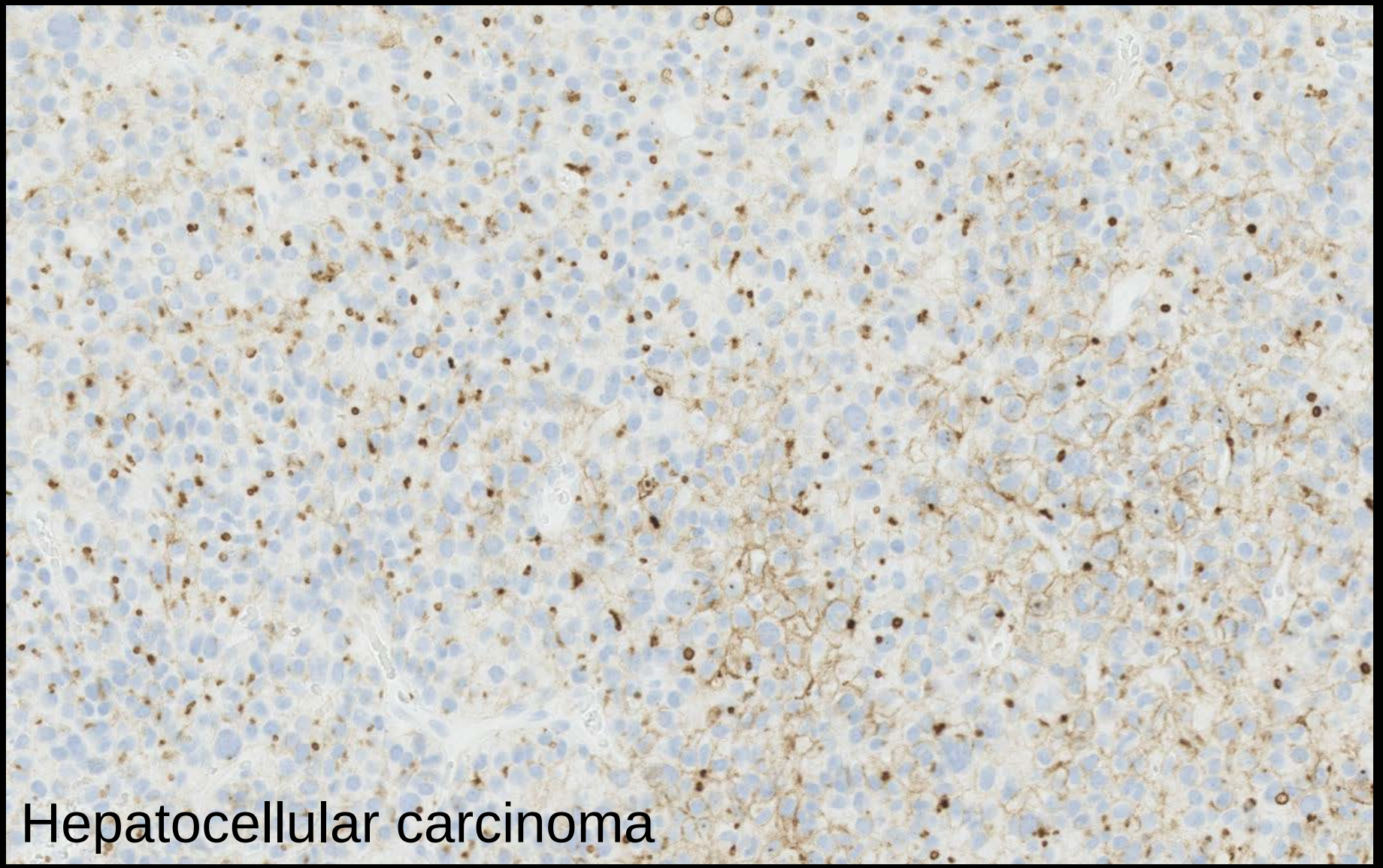
CEA-like cell adhesion molecule (”pCEA”)

- Bile canaliculi
- Many epithelia
- Trophoblast

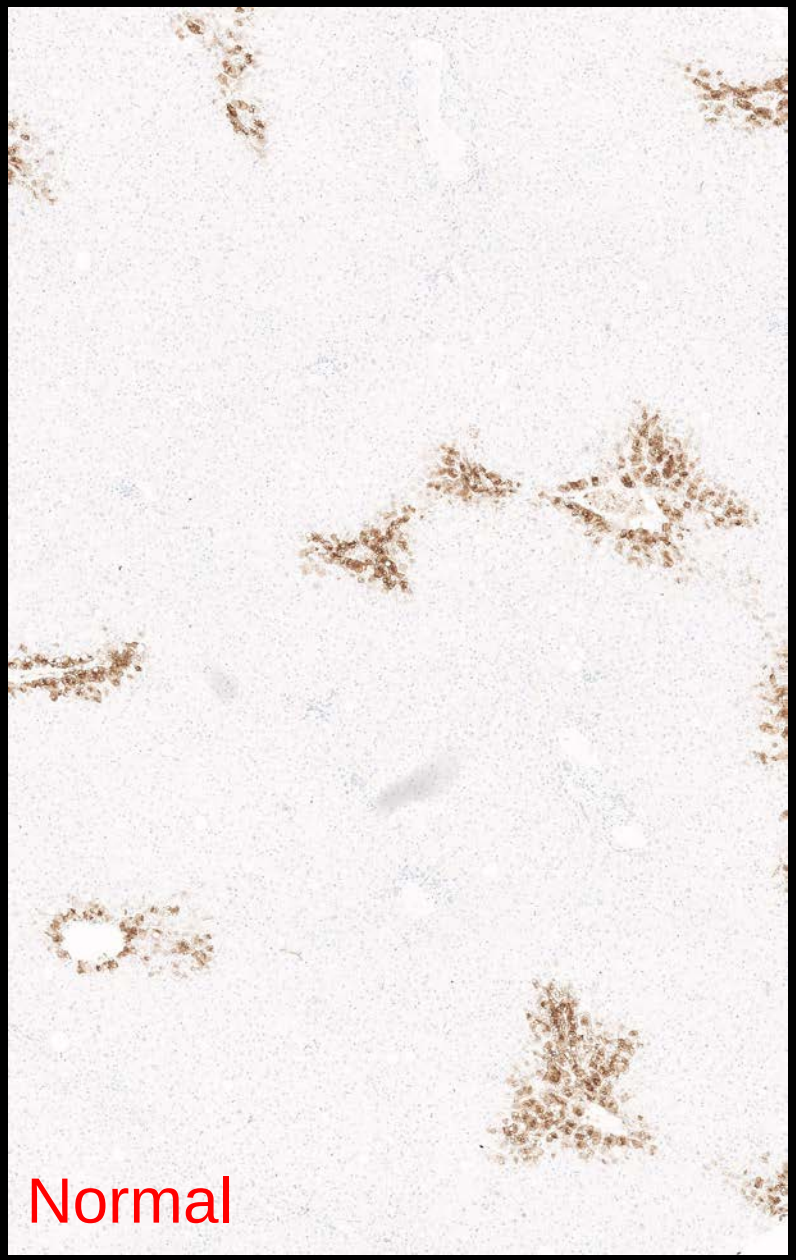
CD10 shows the same staining pattern



canCD66a (biliary glycoprotein-1)



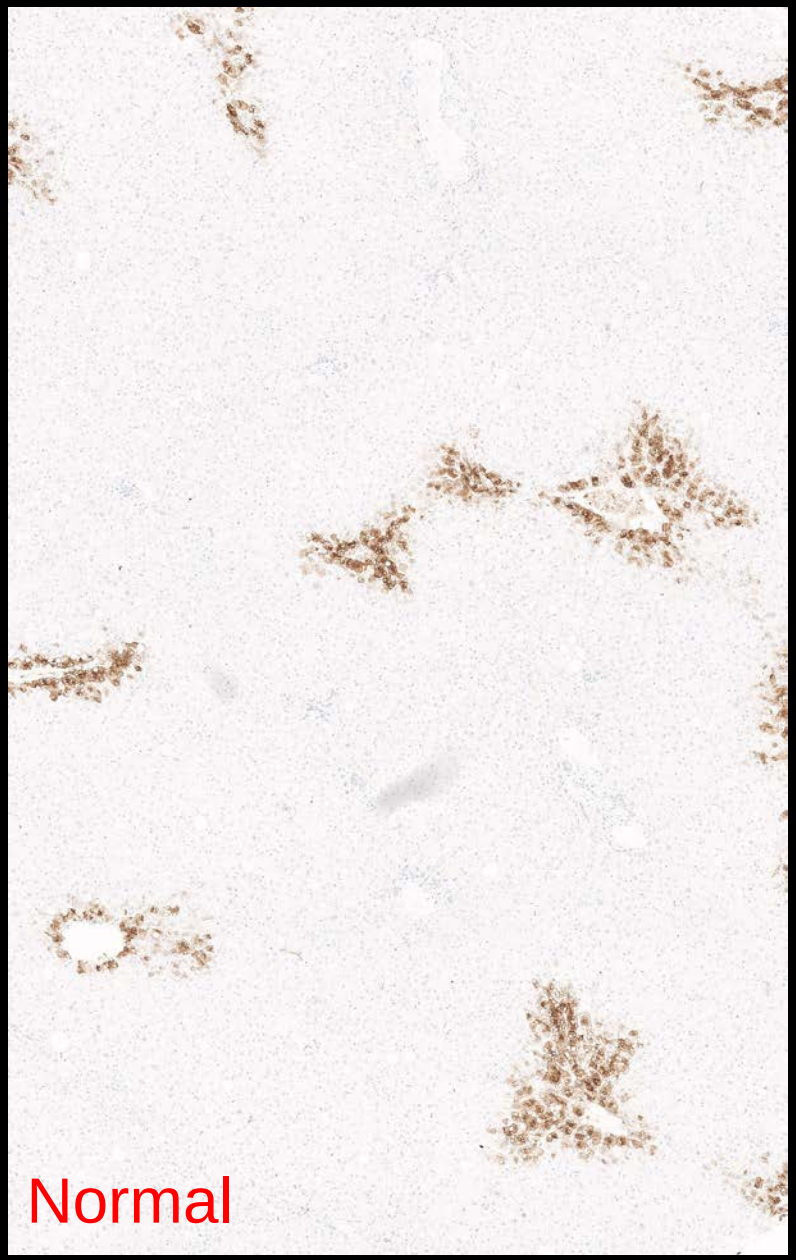
Glutamine synthetase in liver



GS: Member of an enzyme family that catalyzes the synthesis of glutamine from glutamate and ammonia.

Plays an important role in ammonia detoxification, nitrogen balance and pH regulation in the liver

Glutamine synthetase in liver

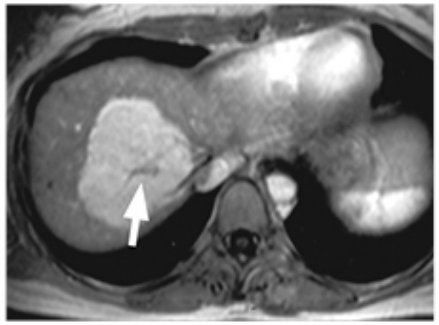


Normal

Focal nodular hyperplasia (FNH)

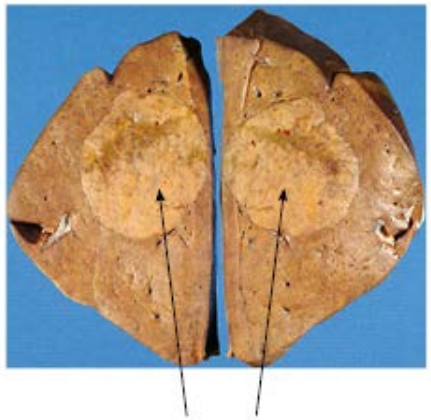
Glutamine synthetase in liver

Focal Nodular Hyperplasia (FNH)



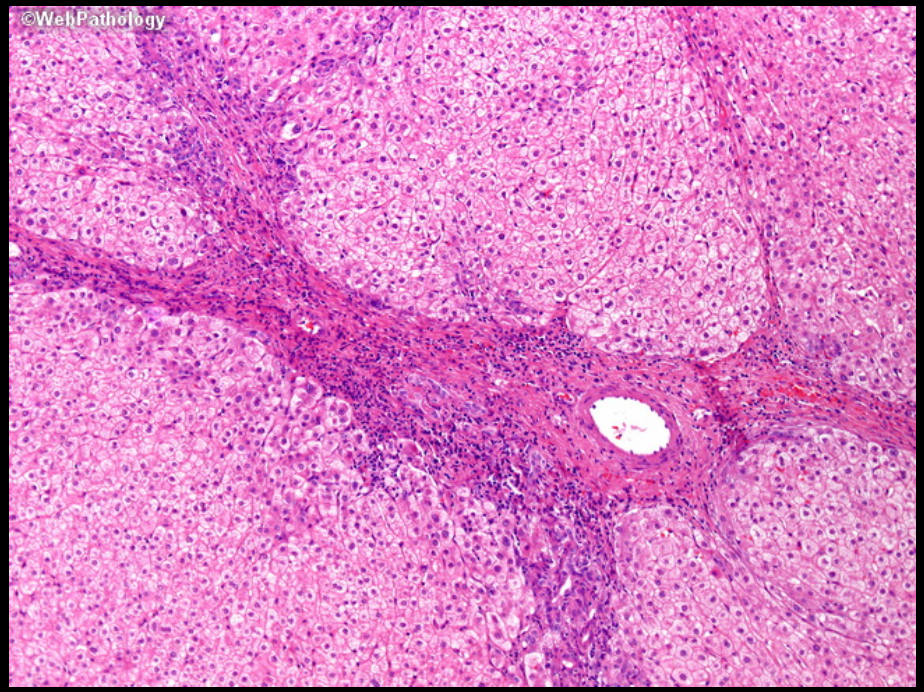
Magnetic Resonance Imaging Scan

Image Credit: Radiological Society of North America



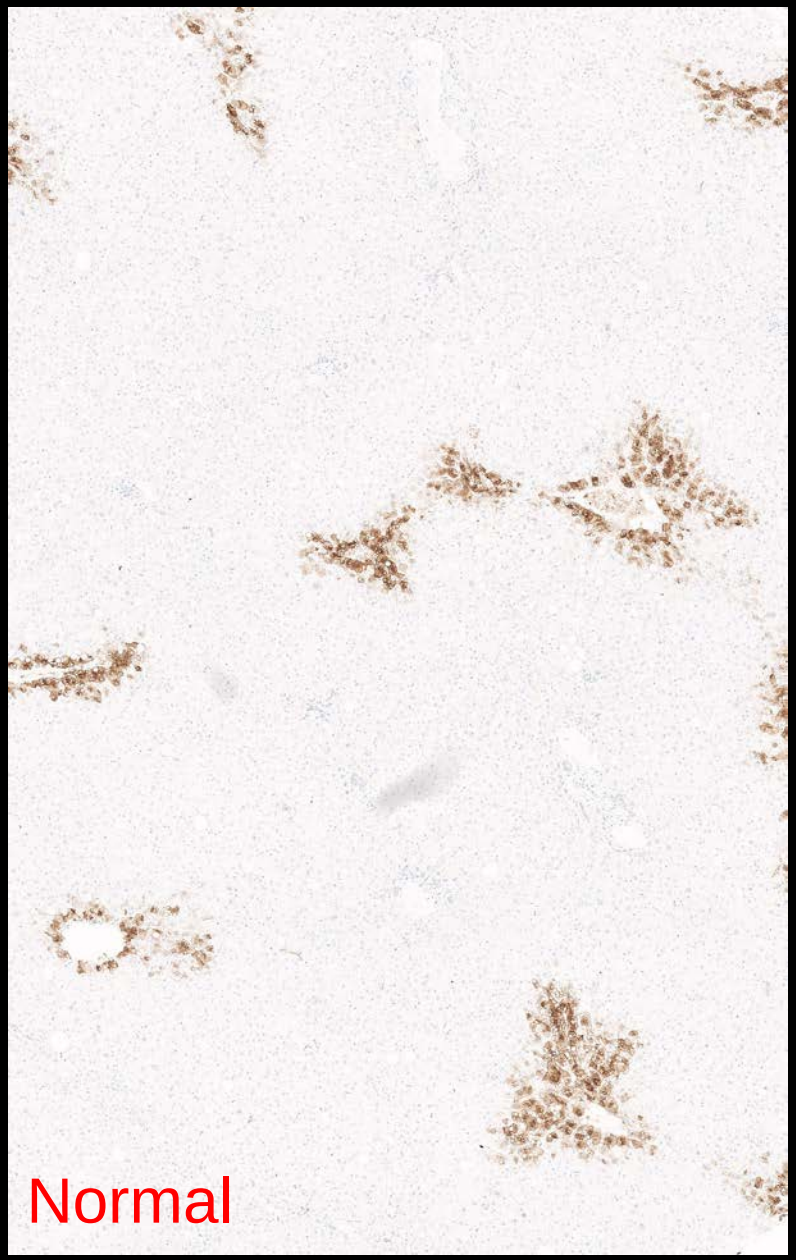
dissected liver showing tumor of FNH

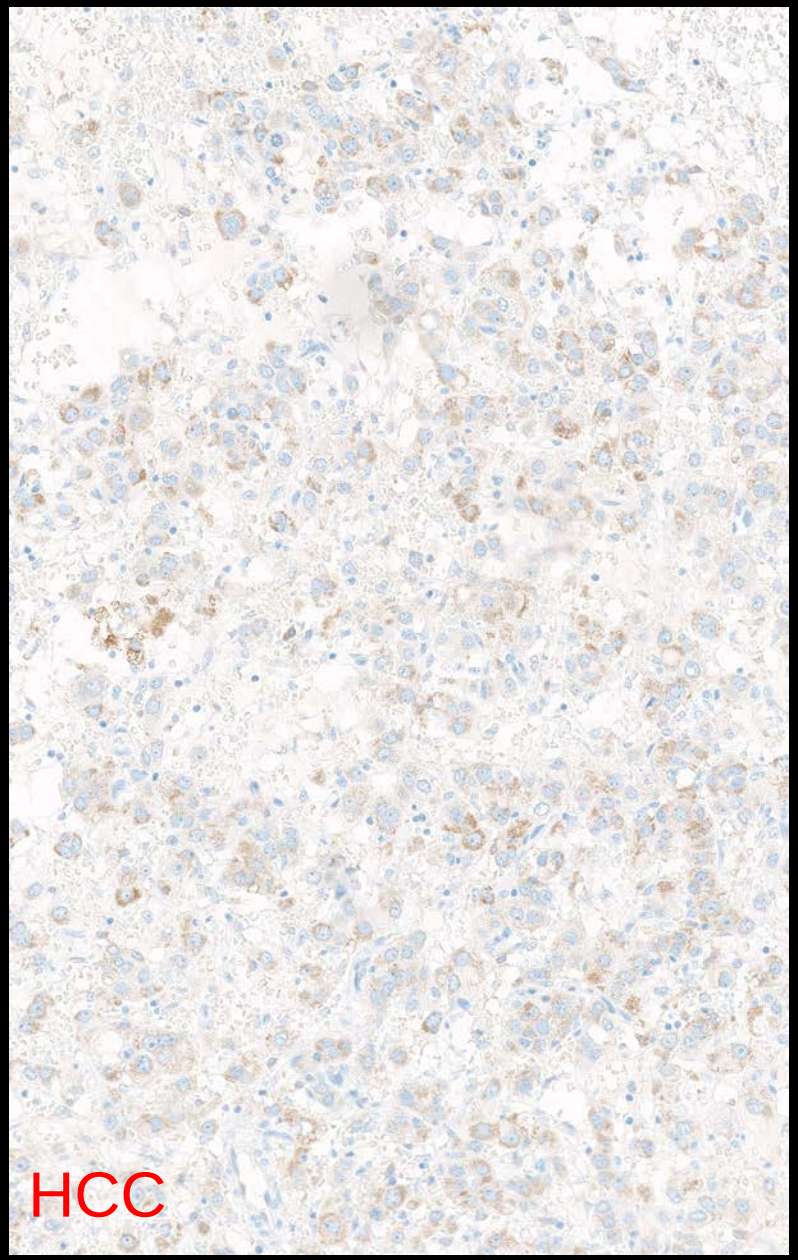
from http://www.humpath.com



Focal nodular hyperplasia (FNH)

Glutamine synthetase in liver





“Pancreas markers”

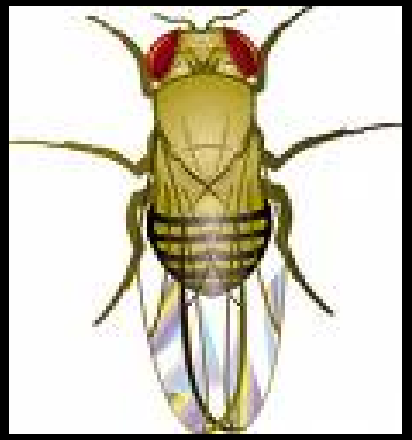
SMAD4	~50% lost du to mutation
GATA3	~50% over-expressed
Maspin	~90% over-expressed
IMP3	~90% over-expressed
pVHL	~90% loss

SMAD4

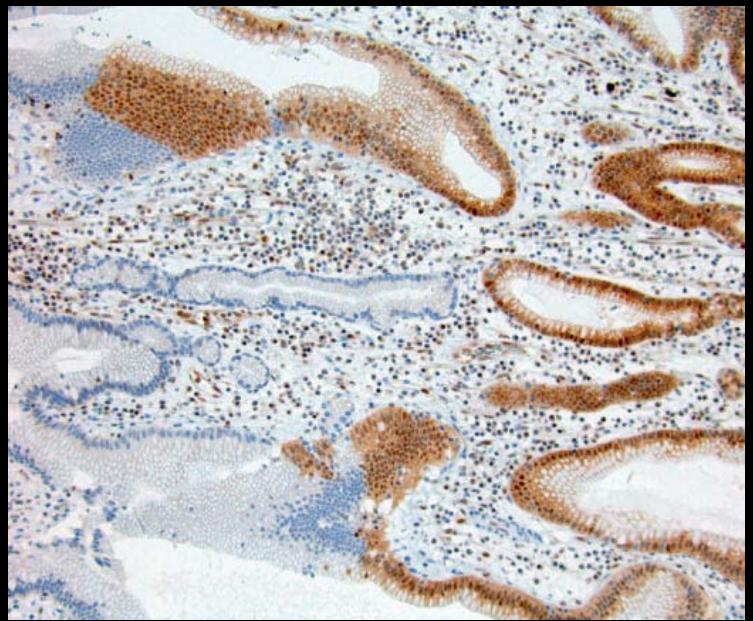
Similar to Mothers Against Drosophila (Decapentaplegic homolog) 4

= Deleted in pancreatic cancer-4 (DPC4)

Nuclear transcription activator in all normal cells

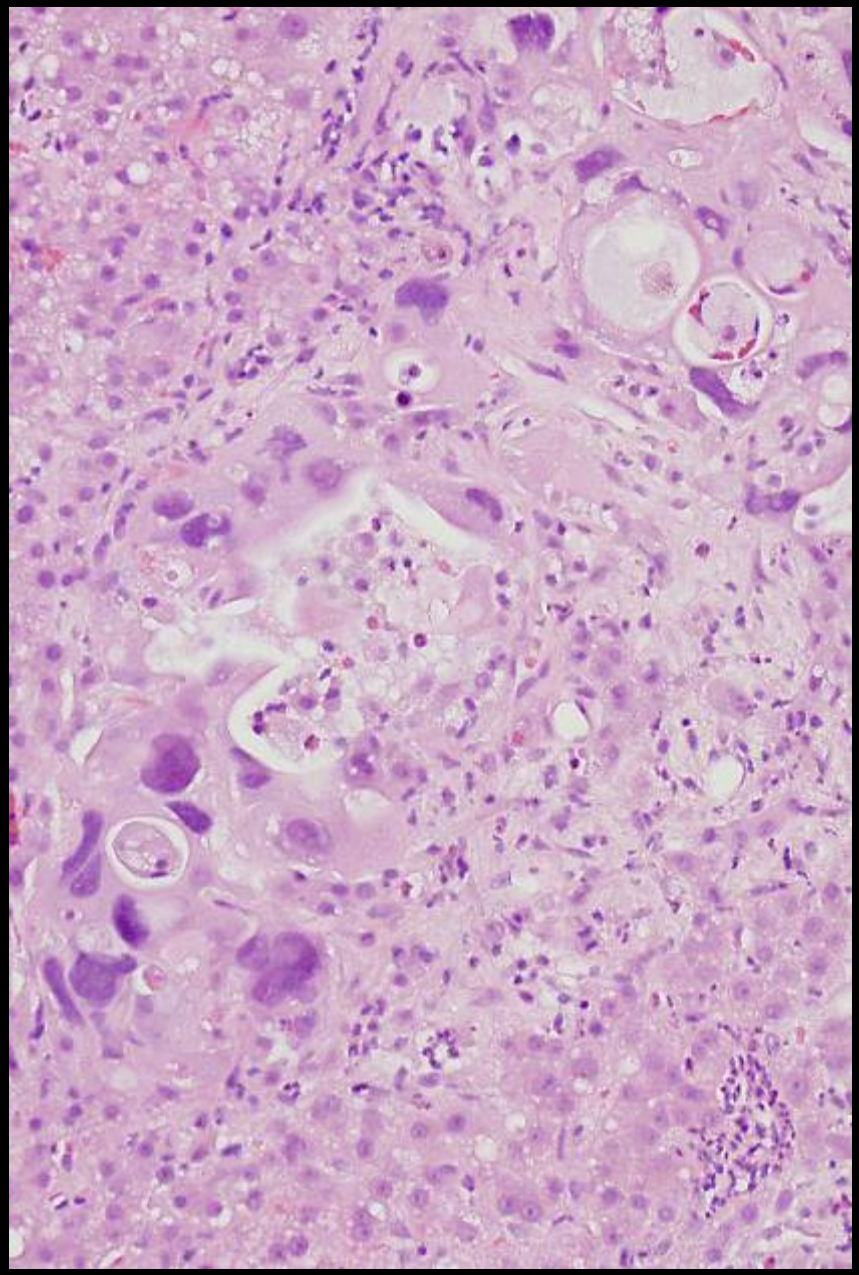


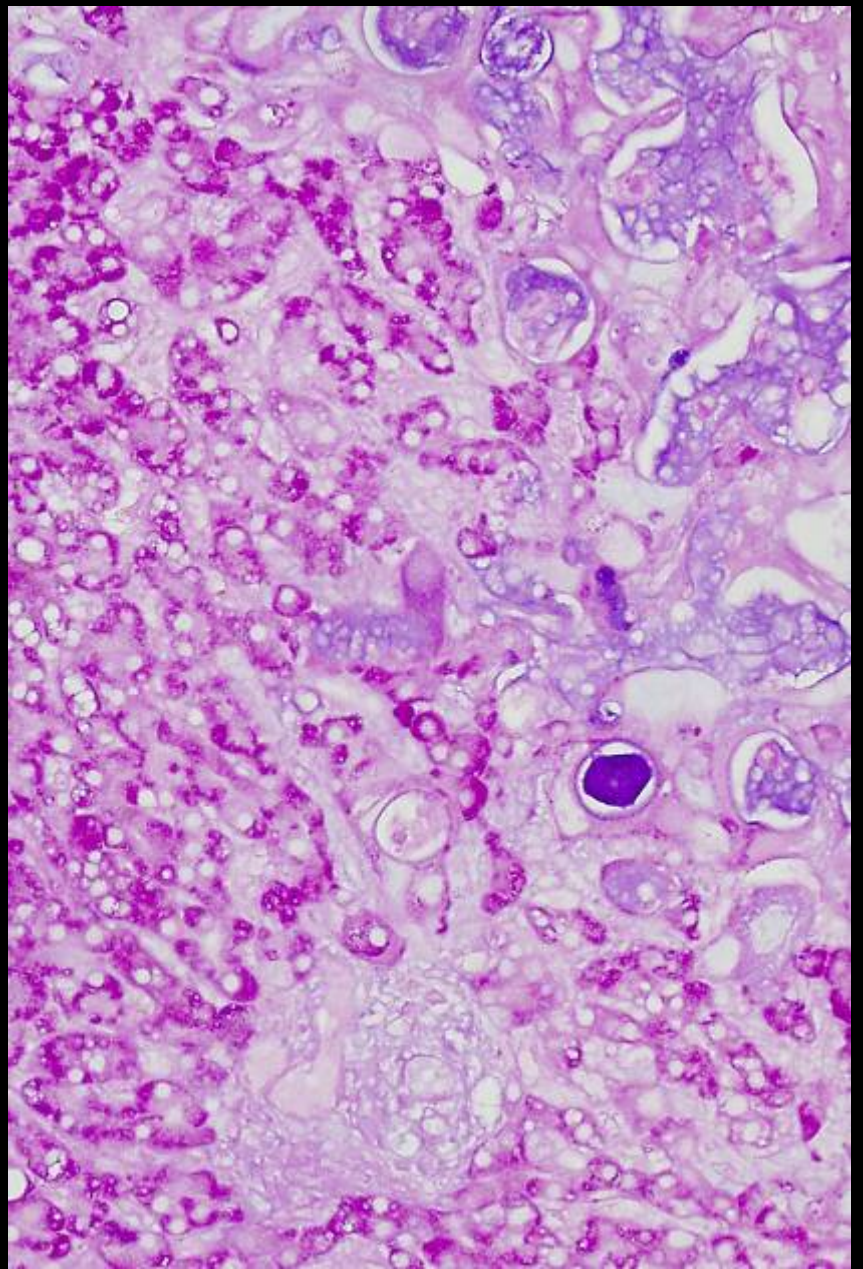
- Pancreatico-biliary carcinomas ~50%
- Intestinal carcinomas ~10%



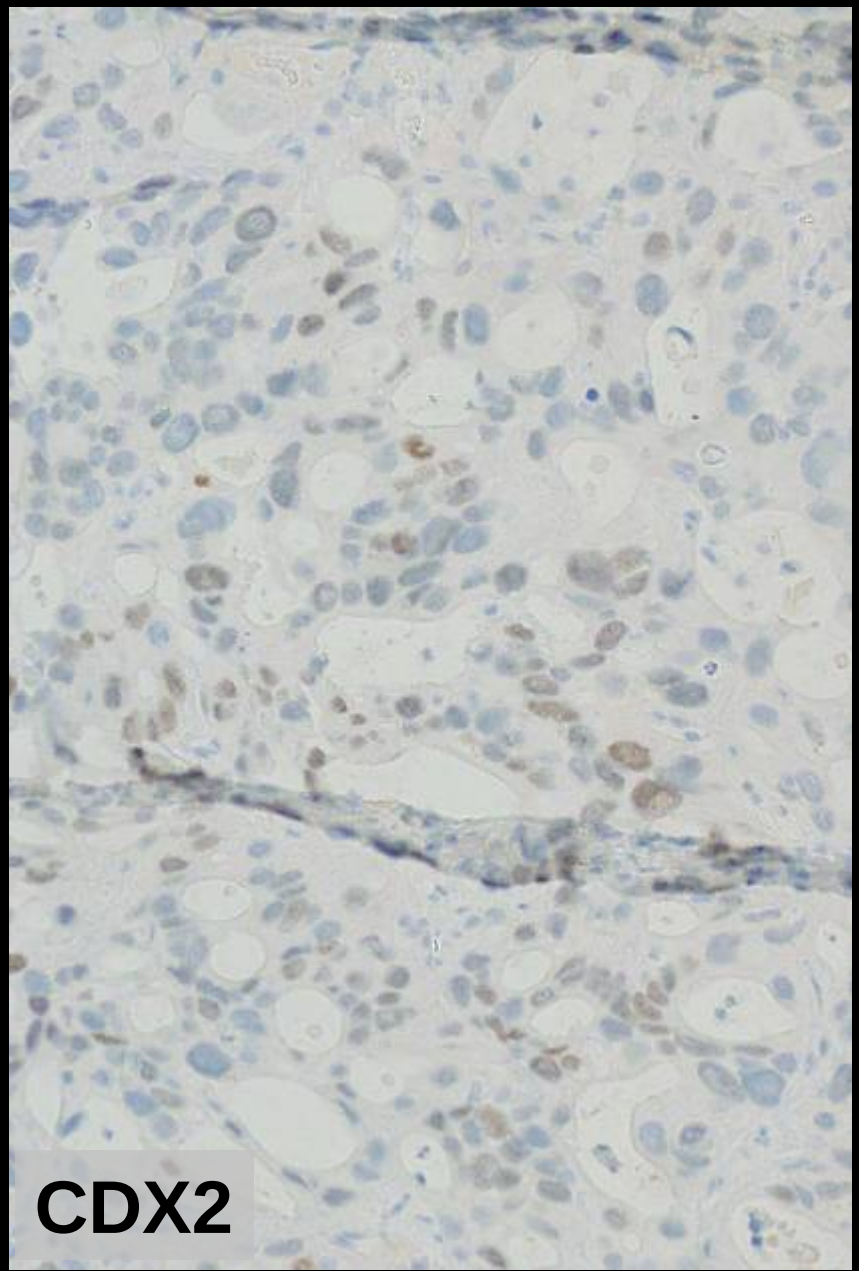
Juvenile polyposis
Lawless et al., AJCP 2017,147: 4, 390

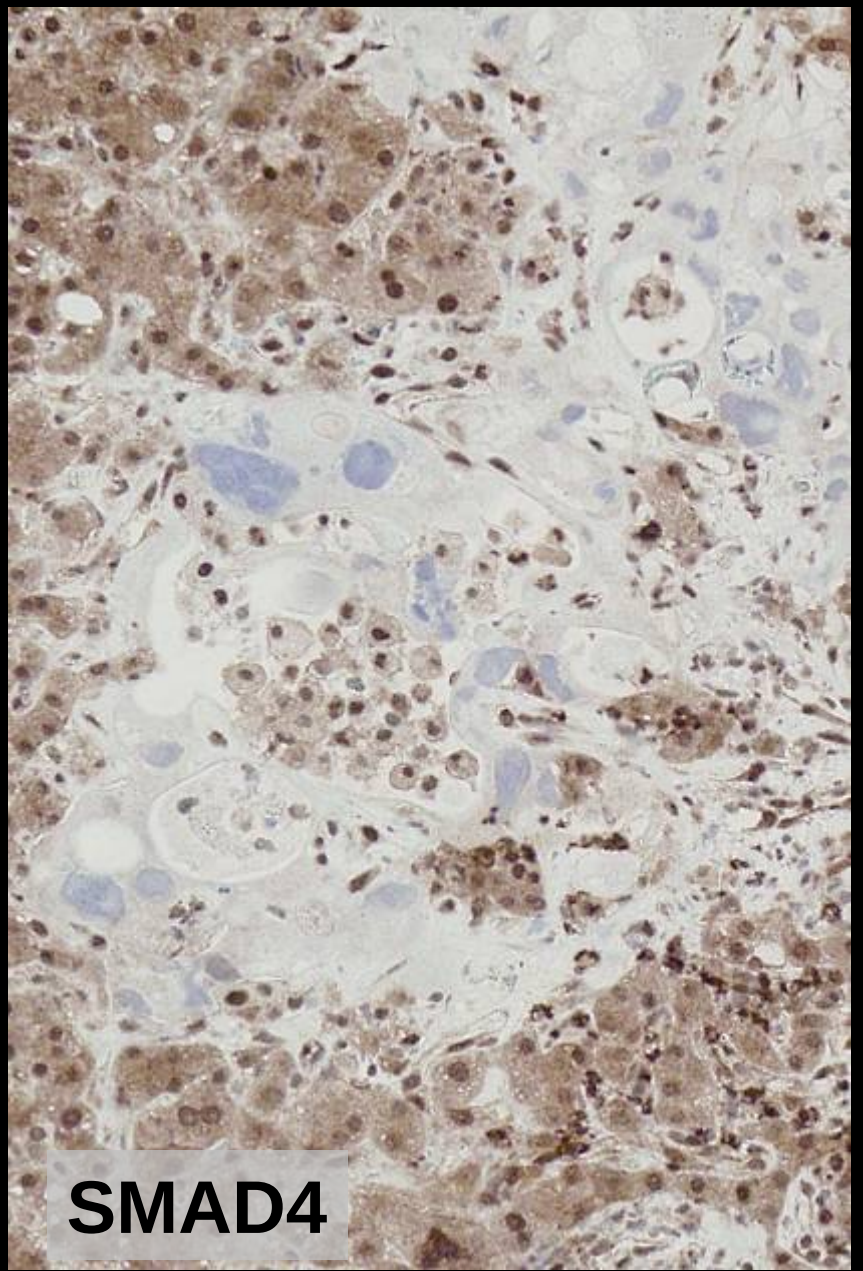
♂ 53 – liver with mestatic adenocarcinoma



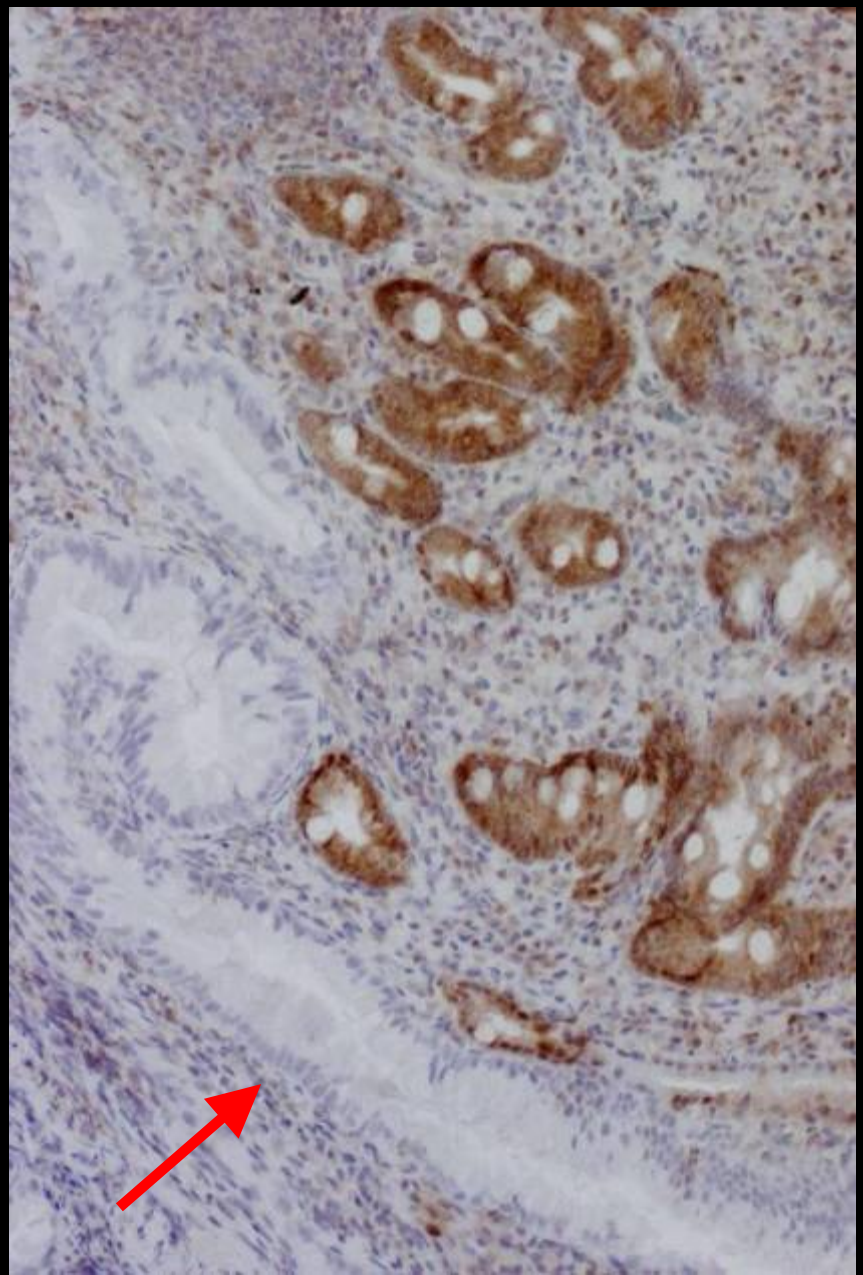


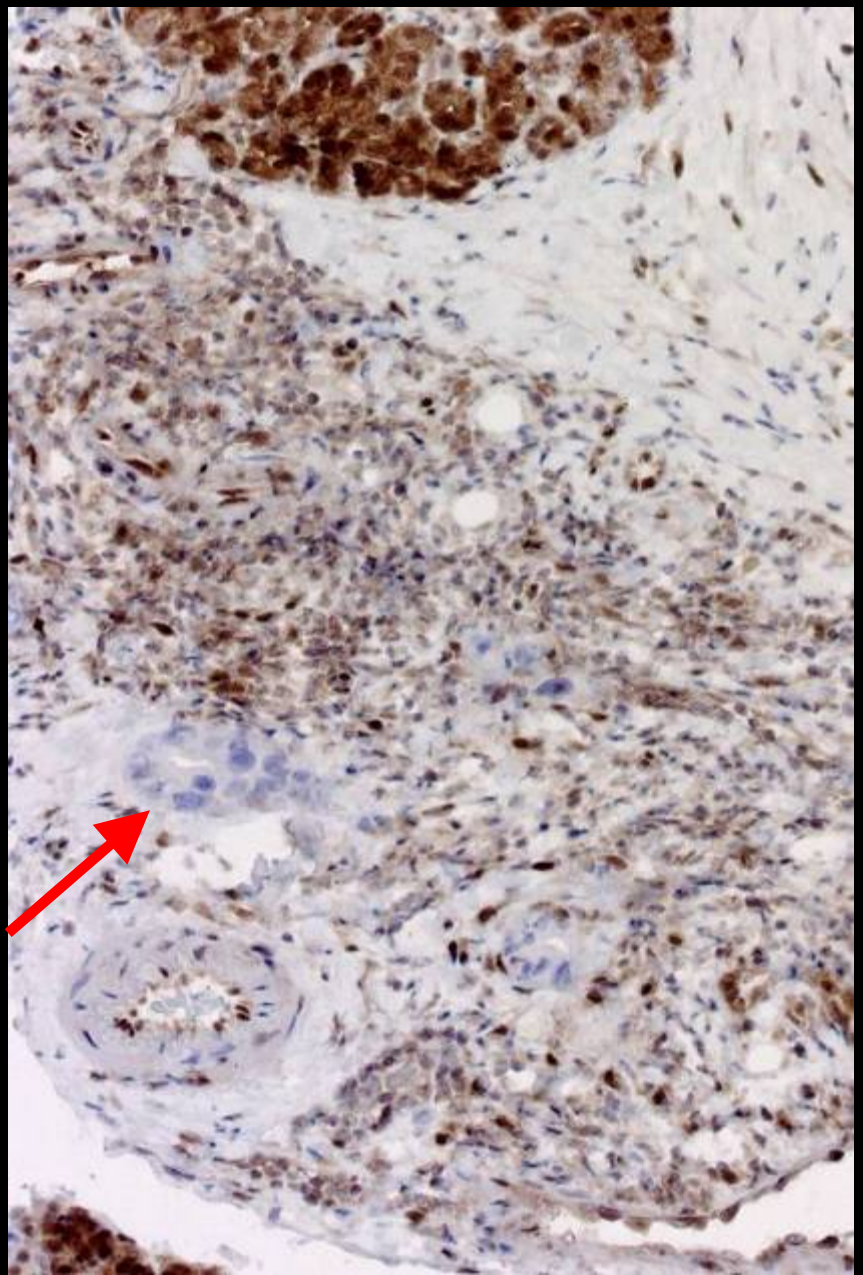
♂ 53 – liver with metastatic adenocarcinoma





SMAD4 loss in pancreatic and ampullary carcinomas



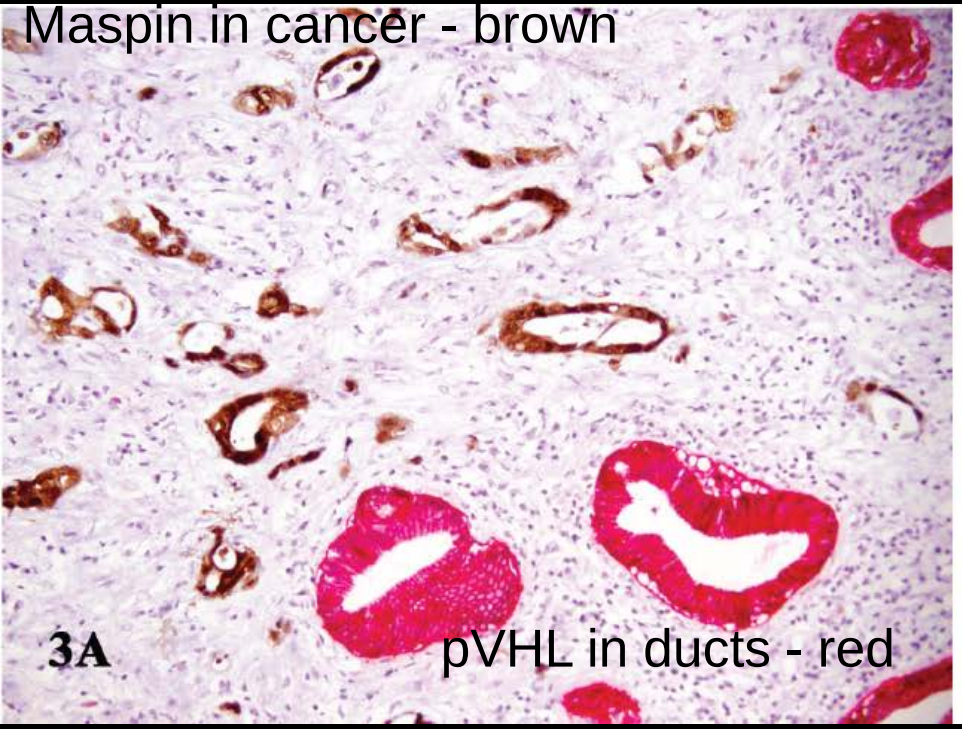


Reevaluation and Identification of the Best Immunohistochemical Panel (pVHL, Maspin, S100P, IMP-3) for Ductal Adenocarcinoma of the Pancreas

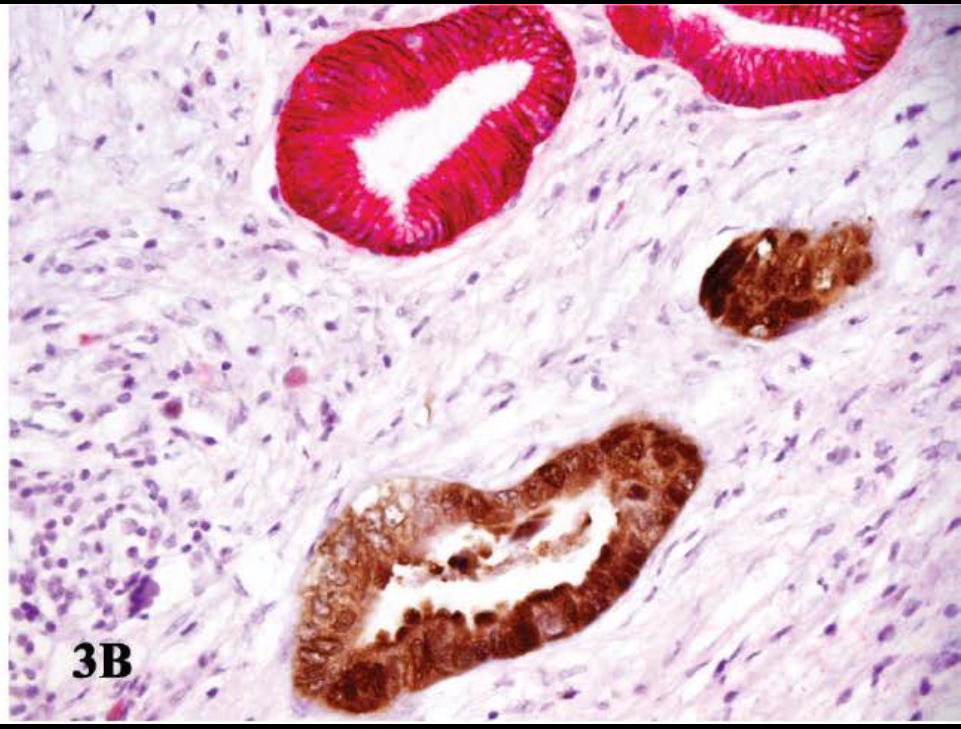
Haiyan Liu, MD; Jianhui Shi, MD, PhD; Vasuki Anandan, MD; Hanlin L. Wang, MD, PhD; David Diehl, MD; Joseph Blansfield, MD; Glenn Gerhard, MD; Fan Lin, MD, PhD

Arch Pathol Lab Med.
2012;136:601–609

Maspin in cancer - brown



pVHL in ducts - red



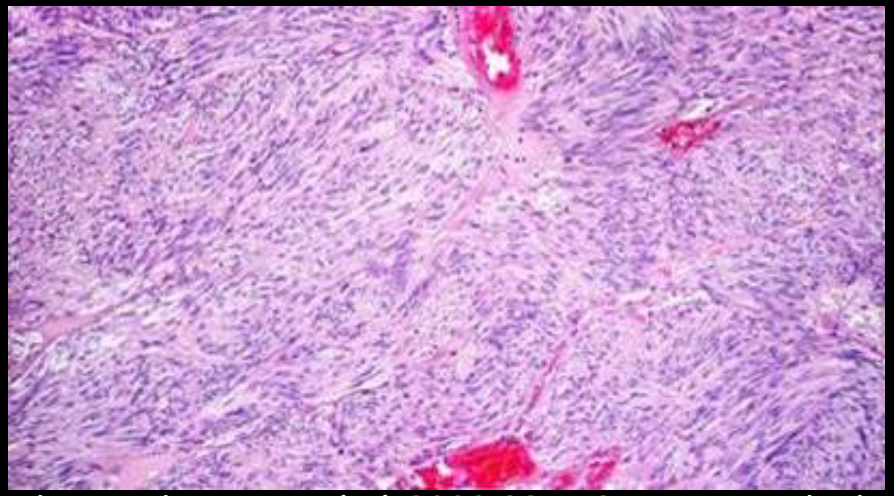
Double staining for Maspin (overexpressed in cancer only) and pVHL (lost in cancer only)

Immunohistochemistry in soft tissue tumours of GI tract

	CD117	DOG1	DES	S100	SOX10	Nucl. β-cat.
Gastrointestinal stromal tumour	**+(-)**	**+(-)**	-(+)	-(+)	-	-(+)
Leiomyoma/ leiomyosarcoma	-(+)	-(+)	**+**	-(+)	-(+)	-
Schwannoma/ MPNST	-(+)	-(+)	-	**+**	**+**	-
Fibromatosis/ desmoid	-/+?	-	+/-	-	-	**+/-**

Gastrointestinal stromal tumour

- Most frequent mesenchymal tumour in GI tract
- Incidence ~15 - 20 / mill. / year (DK ~100 / year)
- Median age 55-65 years (rare before 30), M:F ~1
- Rel. characteristic morphologic, immunohistochemical and mutational patterns



Fletcher et al. *Hum Pathol.* 2002;33:459.
Joensuu et al. *Lancet Oncol.* 2002;3:655.

Miettinen et al. *Pol J Pathol.* 2003;54:3.
Kindblom et al. *Ann Oncol.* 2002;13:157. Abstract 577O.

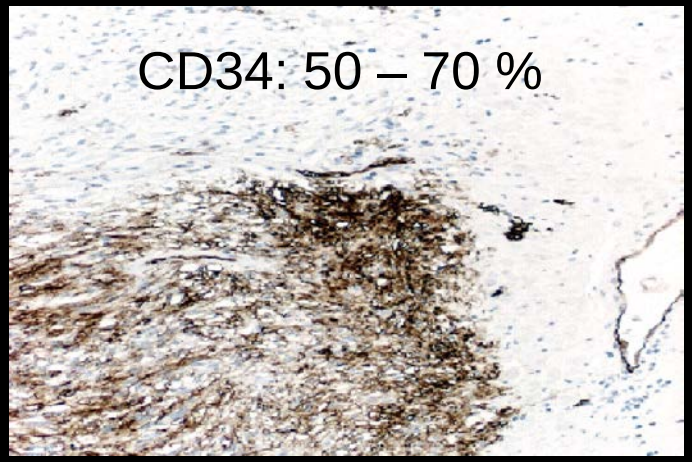
GIST – History

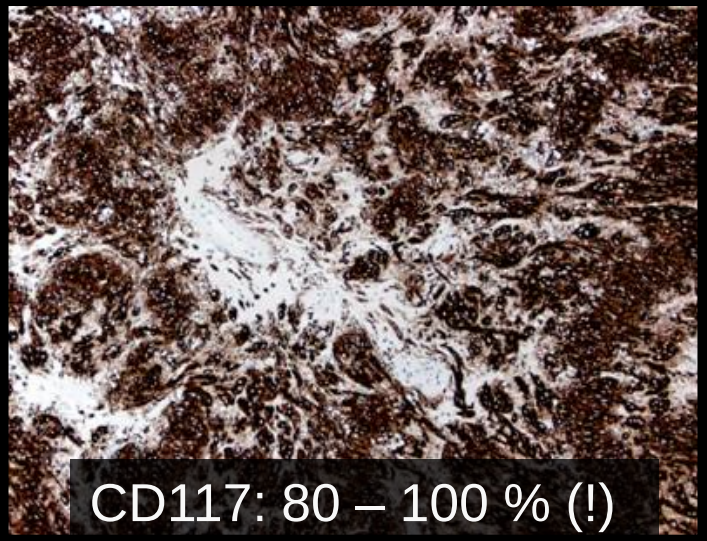
1995 Miettinen et al. (AJSP)

Gastrointestinal stromal tumors – value of progenitor cell antigen (CD34) in their identification and separation from true leiomyomas and schwannomas

1998 Sarlomo-Rikala et al. (Mod. Pat.)

CD117: a sensitive marker for gastrointestinal stromal tumors – more specific than CD34





CD117 mutation in GIST

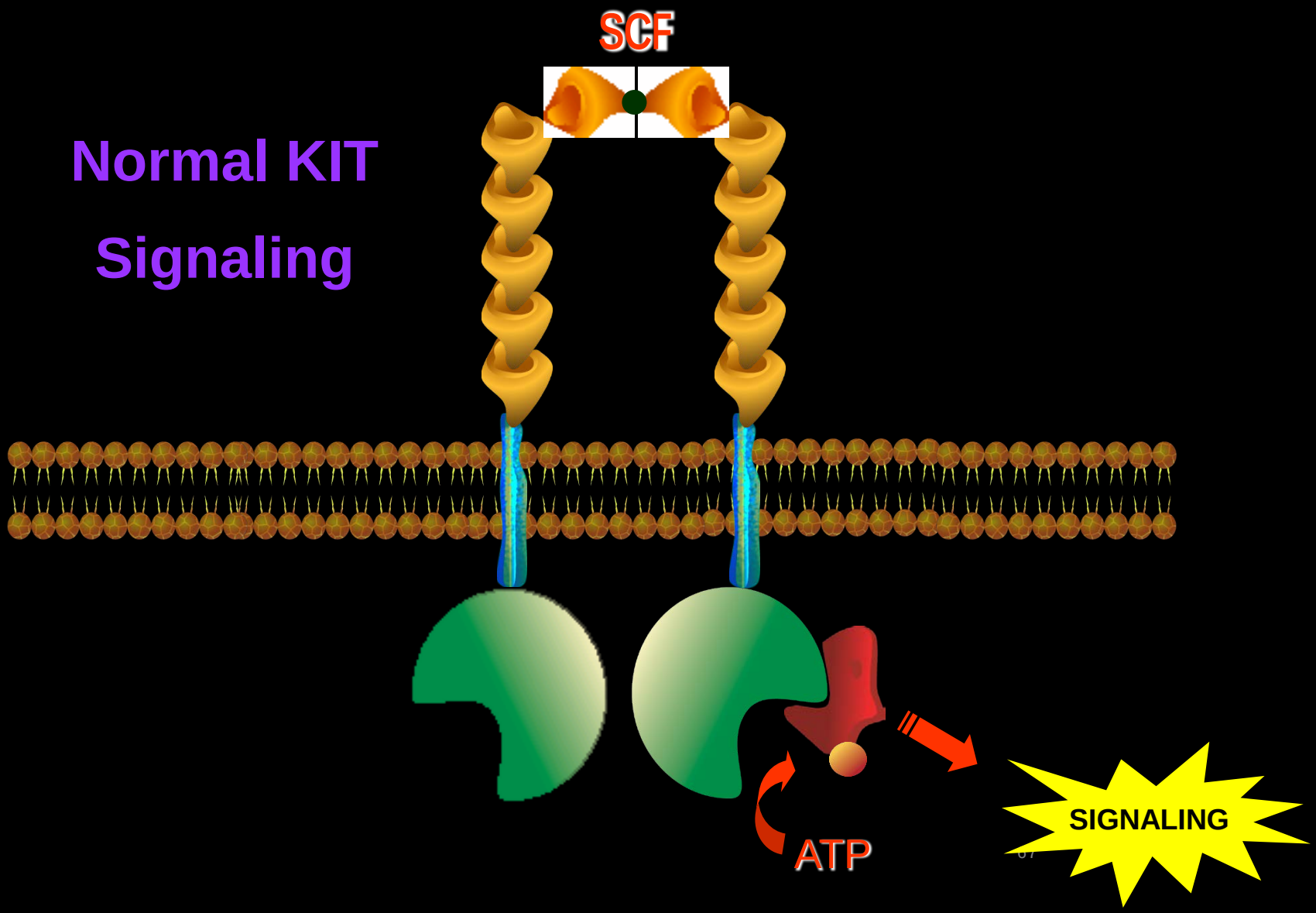
Gain-of-Function Mutations of c-*kit* in Human Gastrointestinal Stromal Tumors

Seiichi Hirota,* Koji Isozaki,* Yasuhiro Moriyama, Koji Hashimoto, Toshirou Nishida, Shingo Ishiguro, Kiyoshi Kawano, Masato Hanada, Akihiko Kurata, Masashi Takeda, Ghulam Muhammad Tunio, Yuji Matsuzawa, Yuzuru Kanakura, Yasuhisa Shinomura, Yukihiko Kitamura†

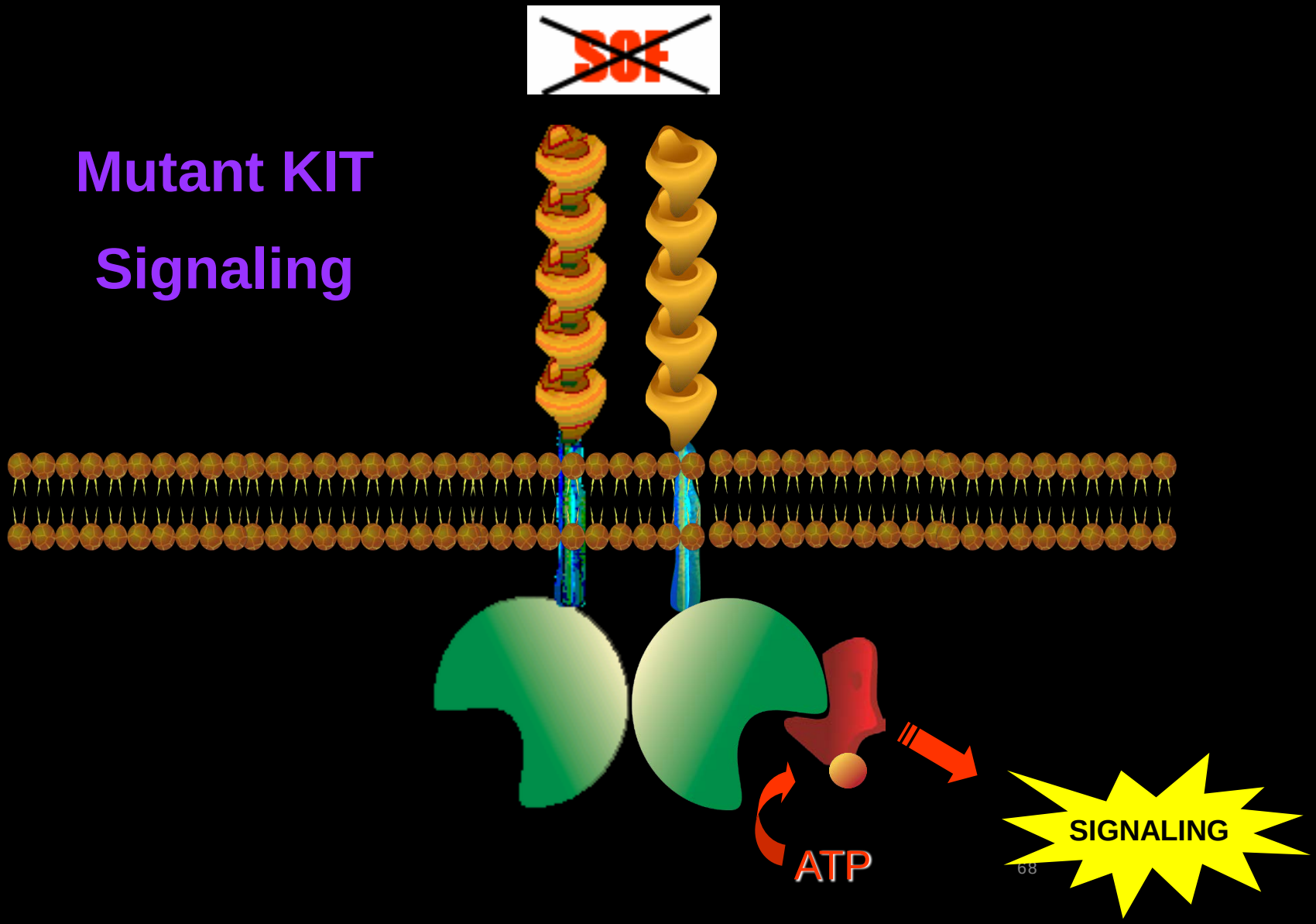
Science *279*:577-580, 1998

- Positive KIT (CD117) staining in 46 of 49 GISTs (94%) *
- Five of six GISTs had mutations in *KIT* gene
- Mutant forms of KIT are constitutively active
- * PDGFRA mutation in ~ 5%

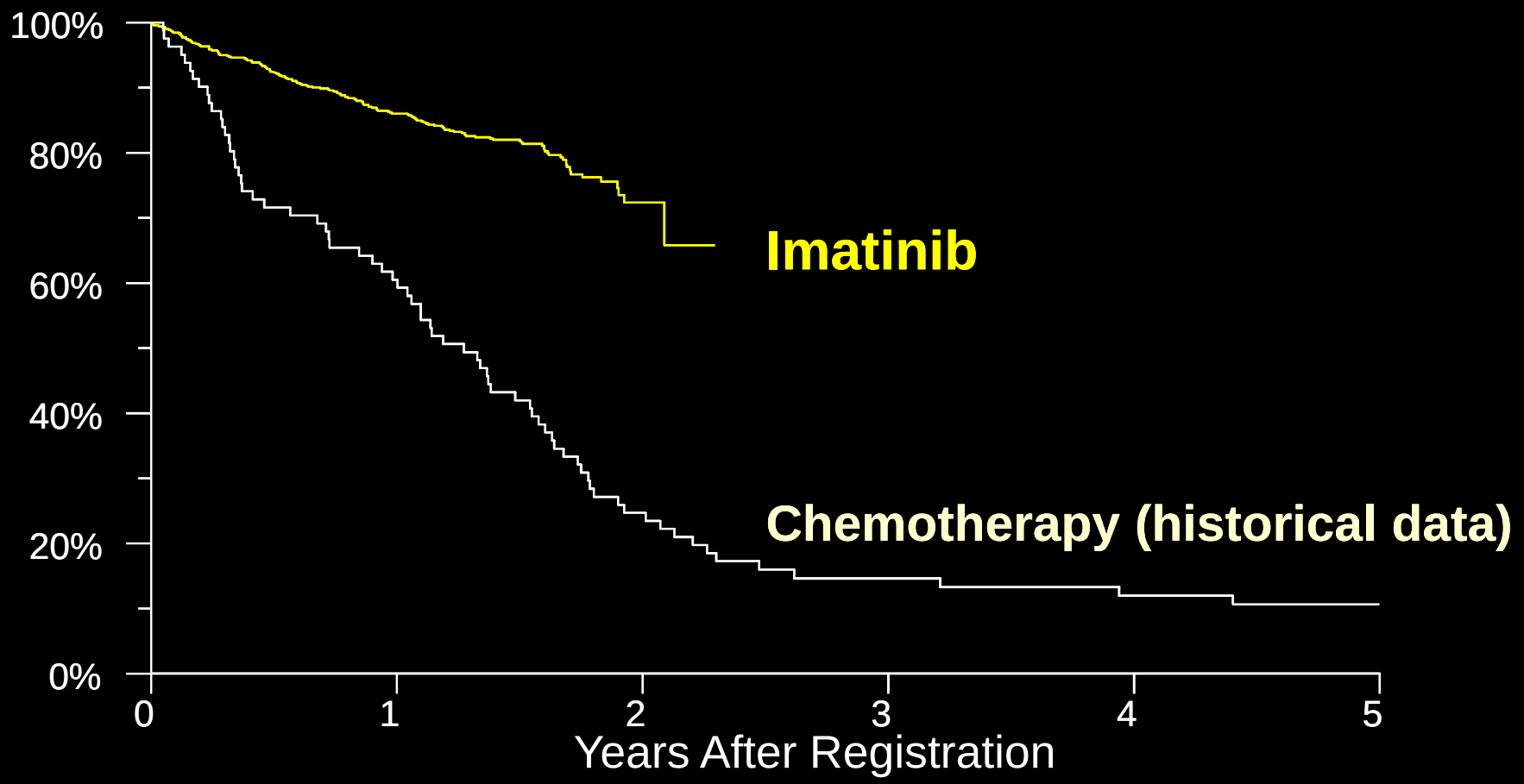
c-kit proto-oncogen protein (KIT, CD117)



c-kit proto-oncogen protein (KIT, CD117)



Metastasising GIST – overall survival

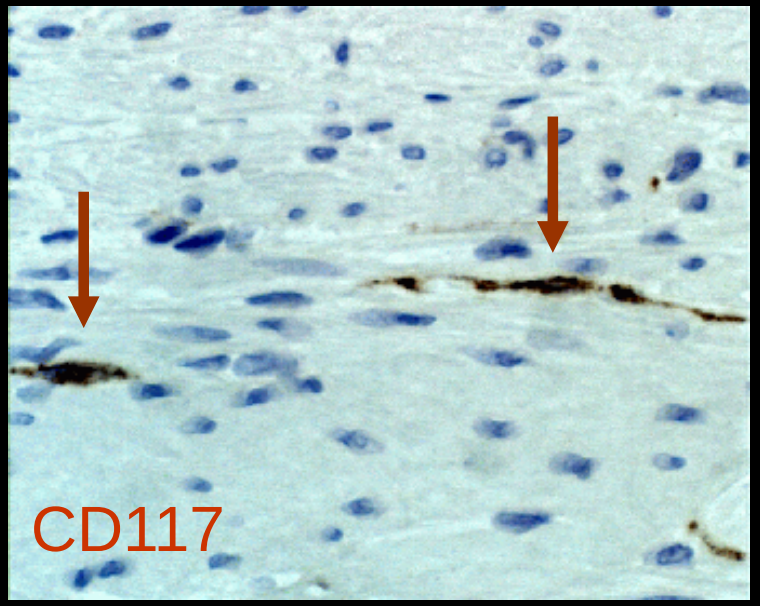


GIST – Cajal cells

1998 Kindblom et al. (AJP)

Gastrointestinal pacemaker cell tumor (GIPACT): gastrointestinal stromal tumors show phenotypic characteristics of the interstitial cells of **Cajal**

- Pacemaker cells of the gut
- Associated with enteric neural plexus
- Intercalated between intramural neurons and smooth muscle cells
- Generate electrical slow waves



GIST – Cajal cells

The Nobel Prize in Physiology or Medicine 1906

"in recognition of their work on the structure of the nervous system"

Camillo Golgi

1/2 of the prize

Italy

Pavia University
Pavia, Italy

b. 1843
d. 1926

Santiago Ramón y Cajal

1/2 of the prize

Spain

Madrid University
Madrid, Spain

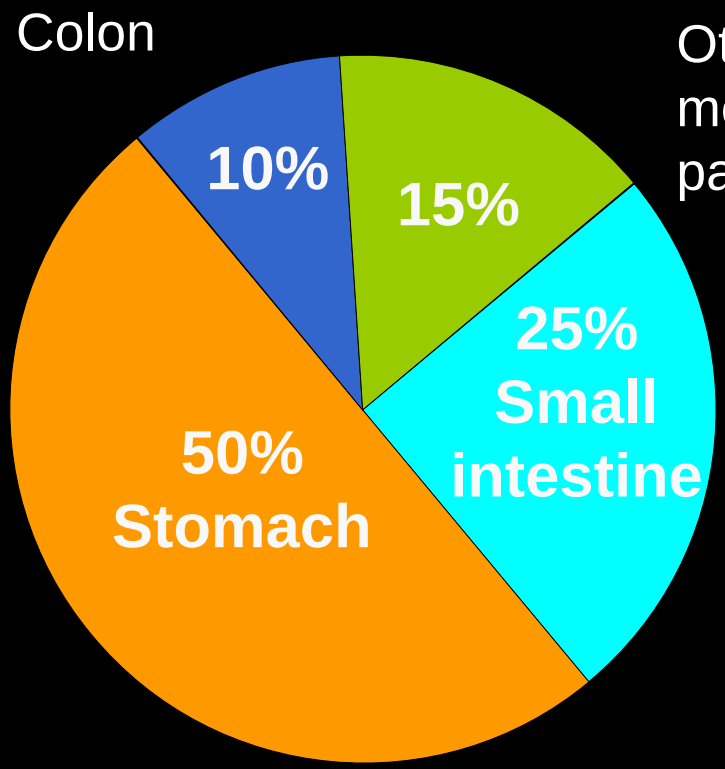
b. 1852
d. 1934

The Nobel Prize in Physiology or Medicine 1906
Presentation Speech
Article

Camillo Golgi
Biography
Nobel Lecture
Nobel Diploma
Swedish Nobel Stamps
Article

Santiago Ramón y Cajal
Biography
Nobel Lecture
Swedish Nobel Stamps
Article

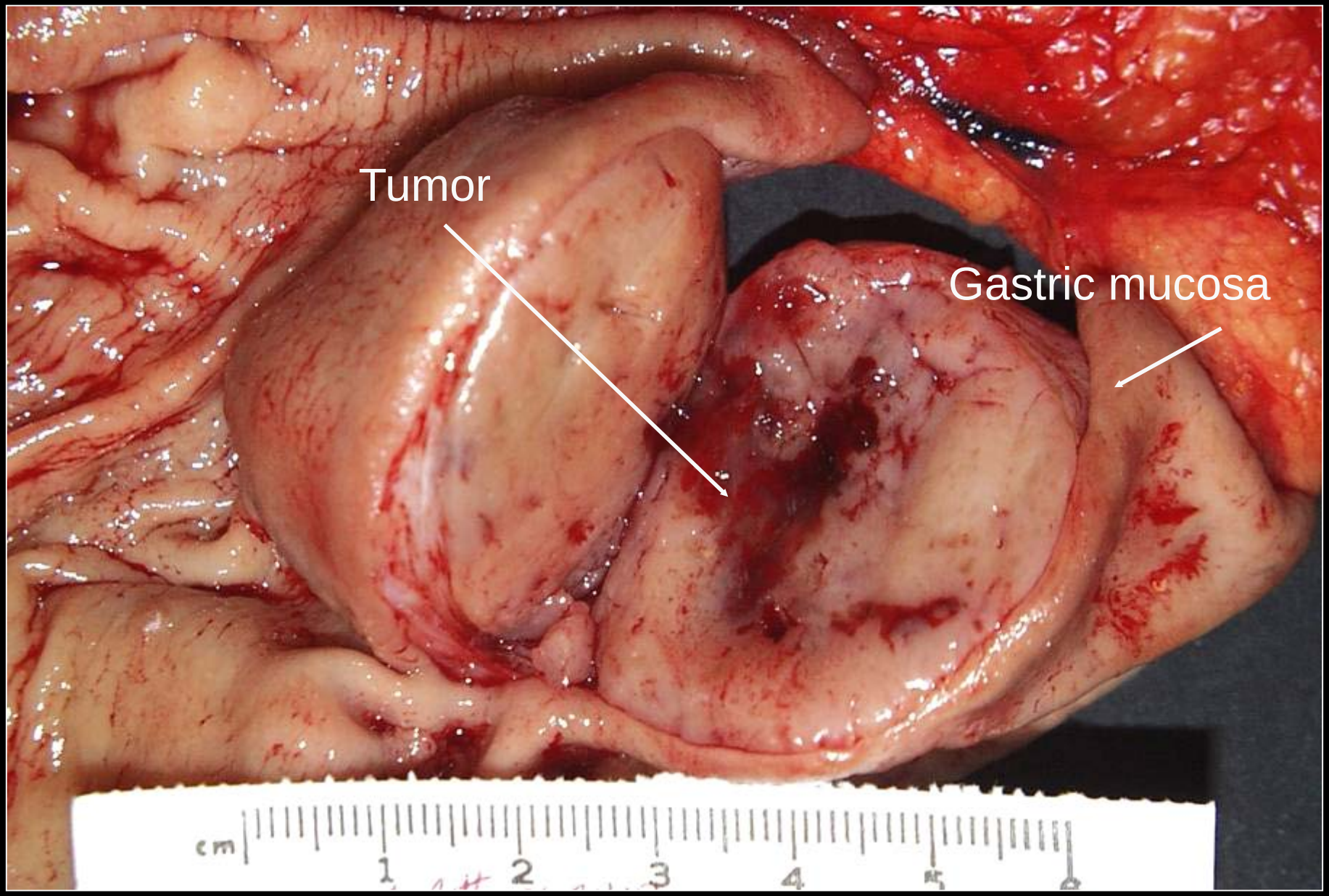
GIST – localisation



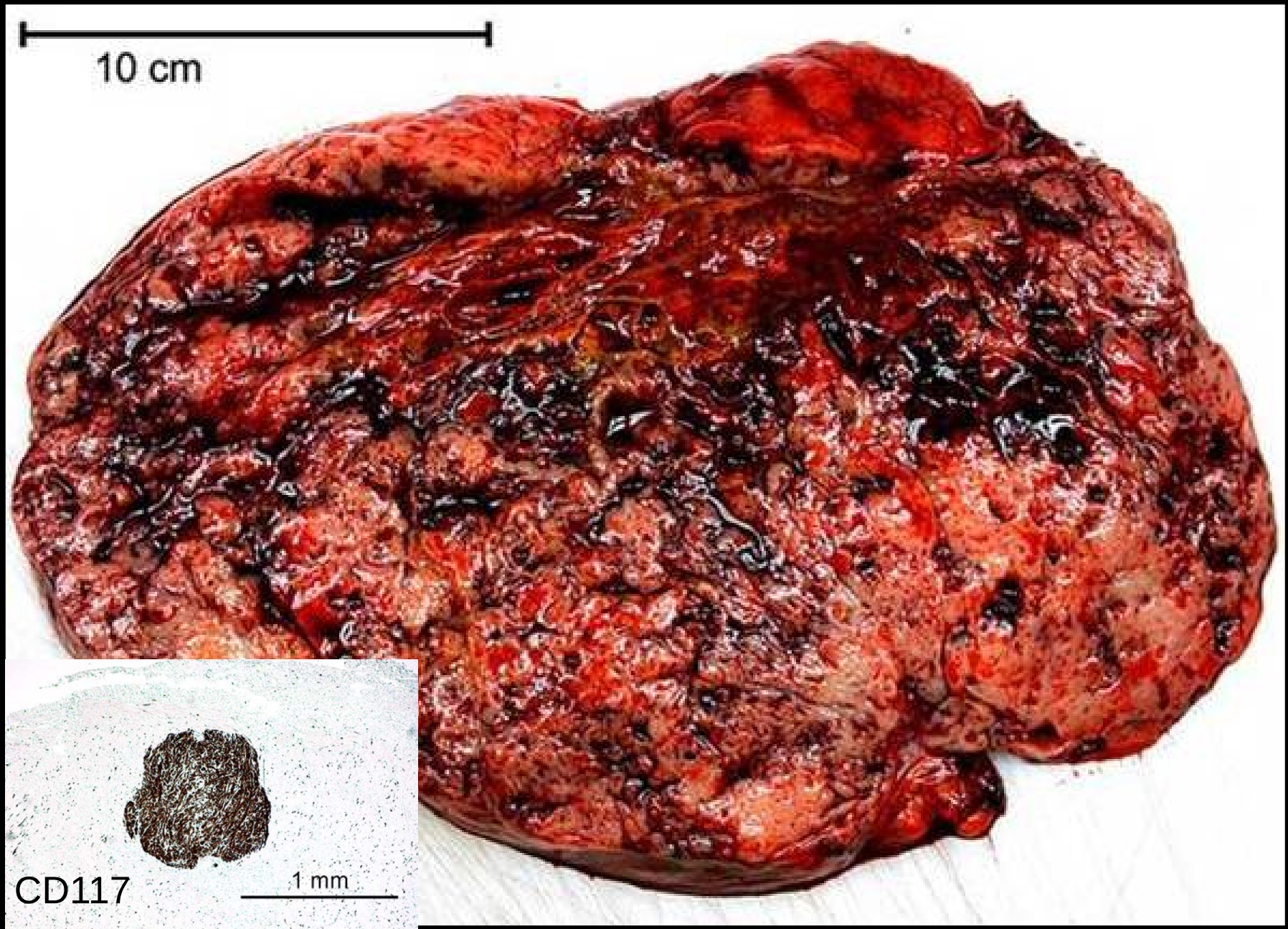
Other (rectum, esophagus, mesentery, retroperitoneum, pancreas, biliary tract . . .)

Emory et al. *Am J Surg Pathol*. 1999;23:82.

GIST – Gross appearance

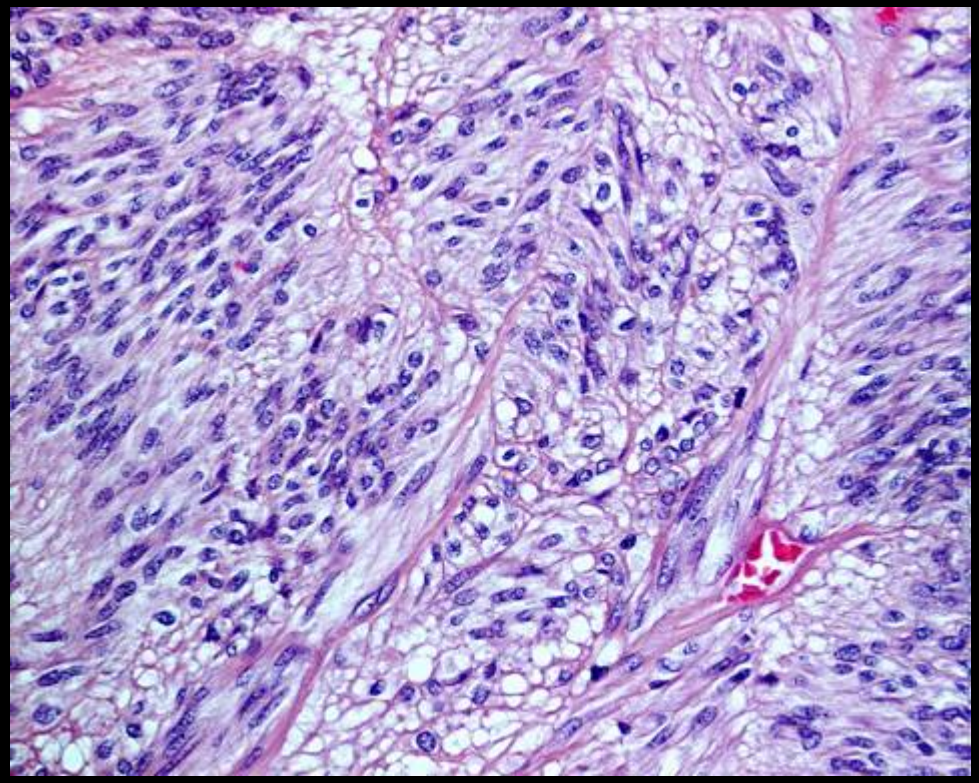


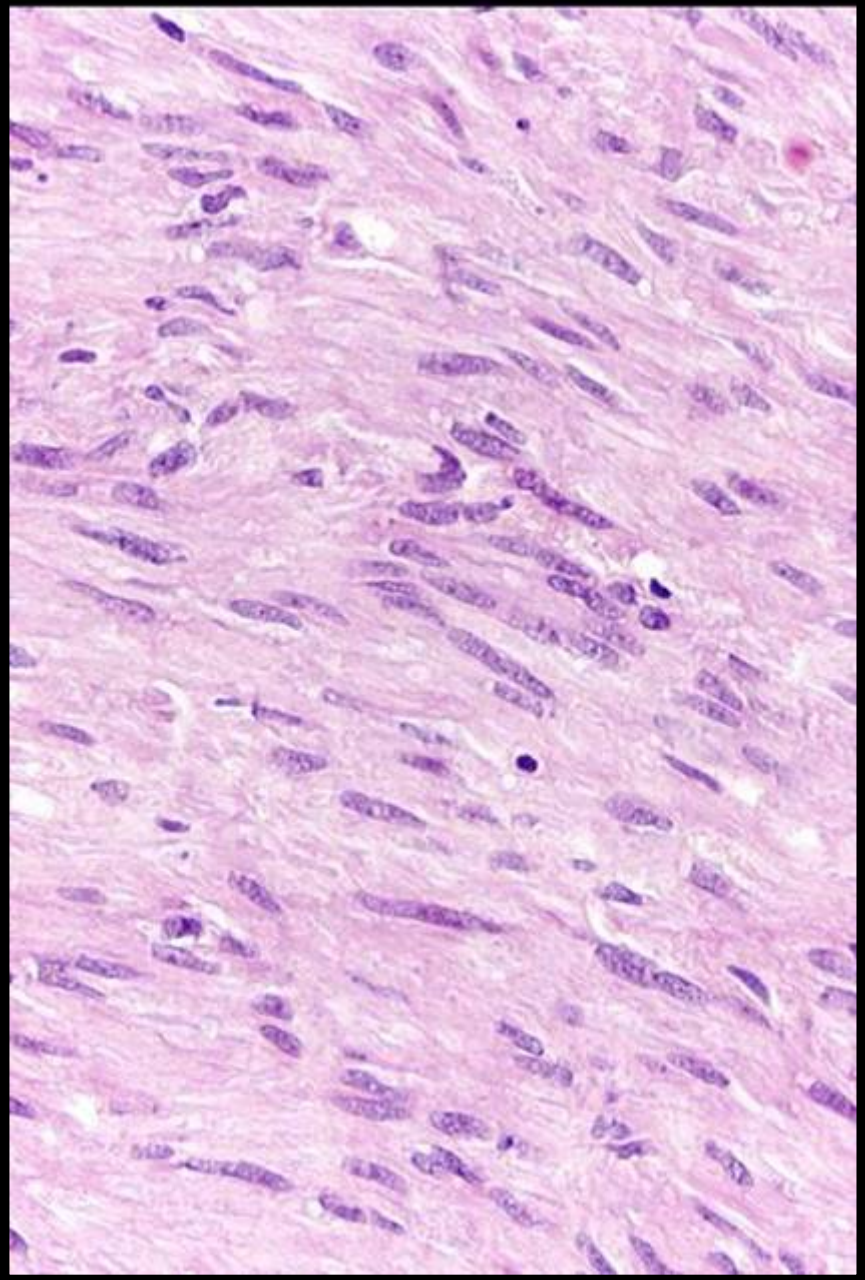
GIST – Gross appearance



GIST – Histology

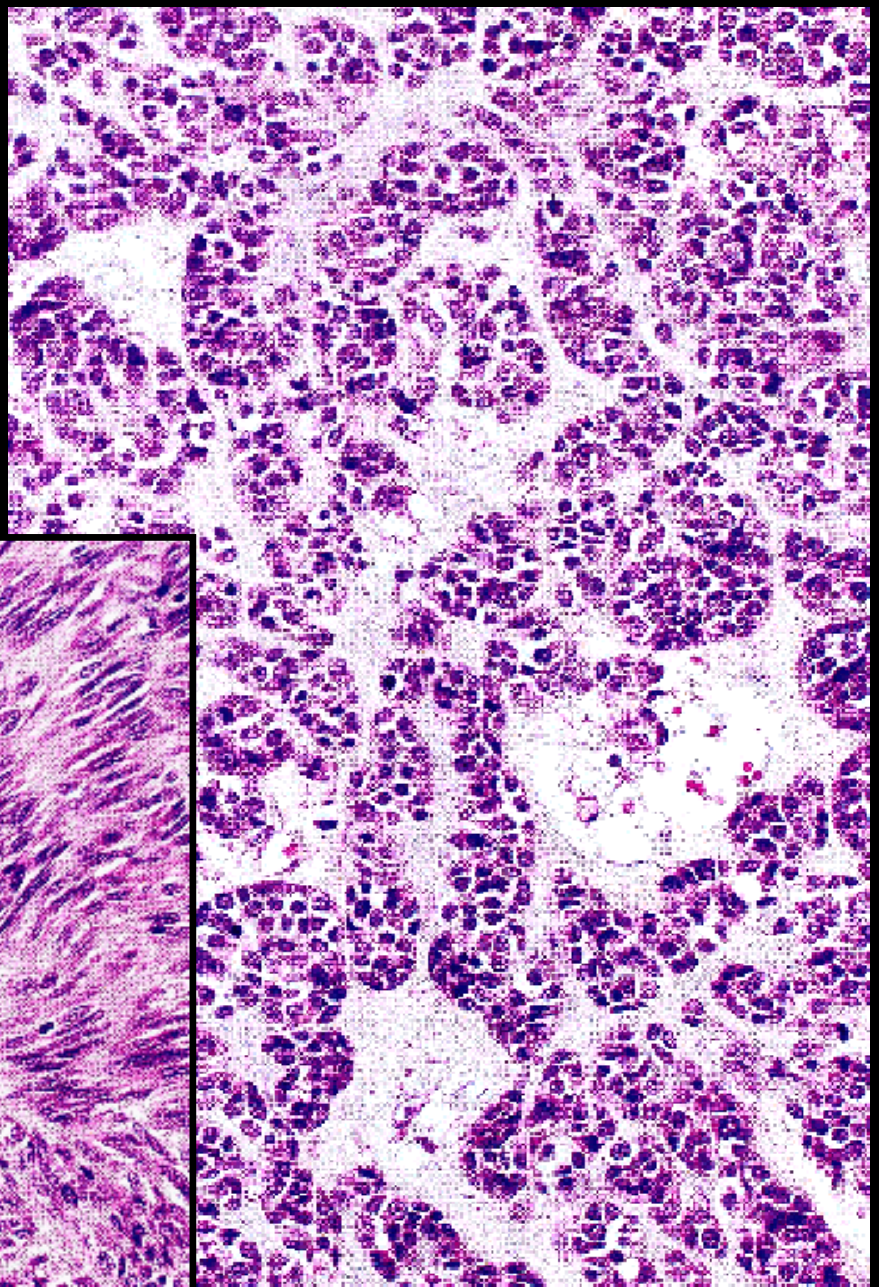
- Spindle cell ~70 %
- Epitheloid - Mixed

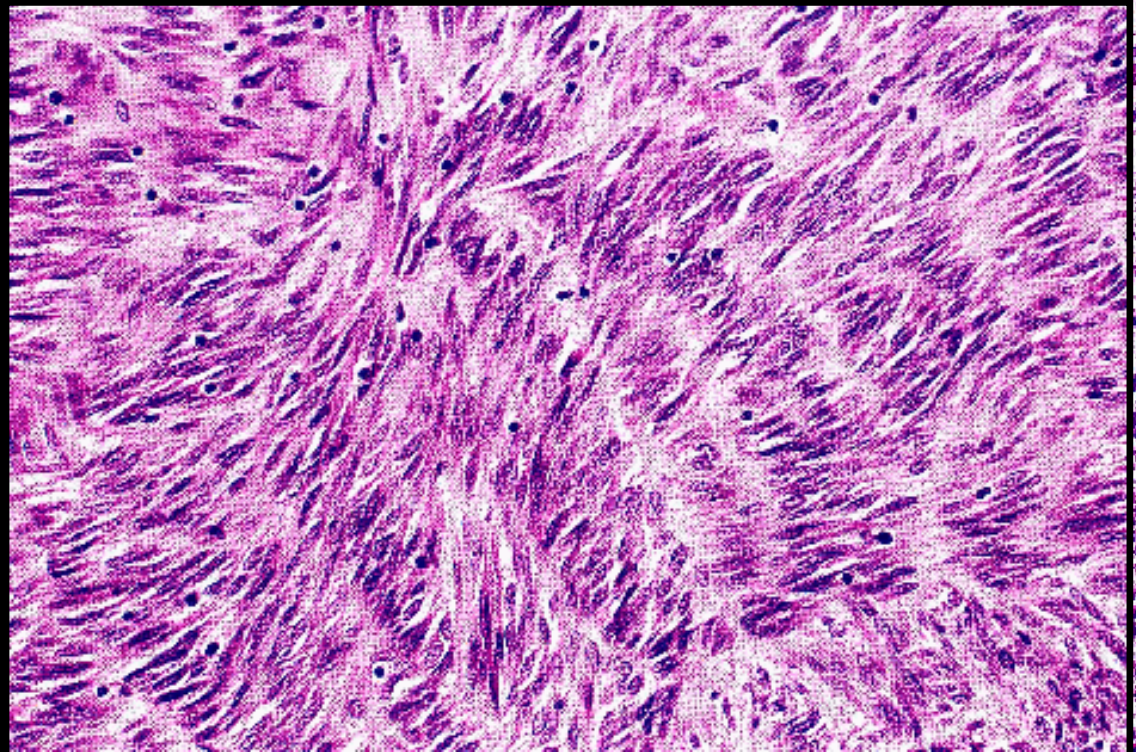




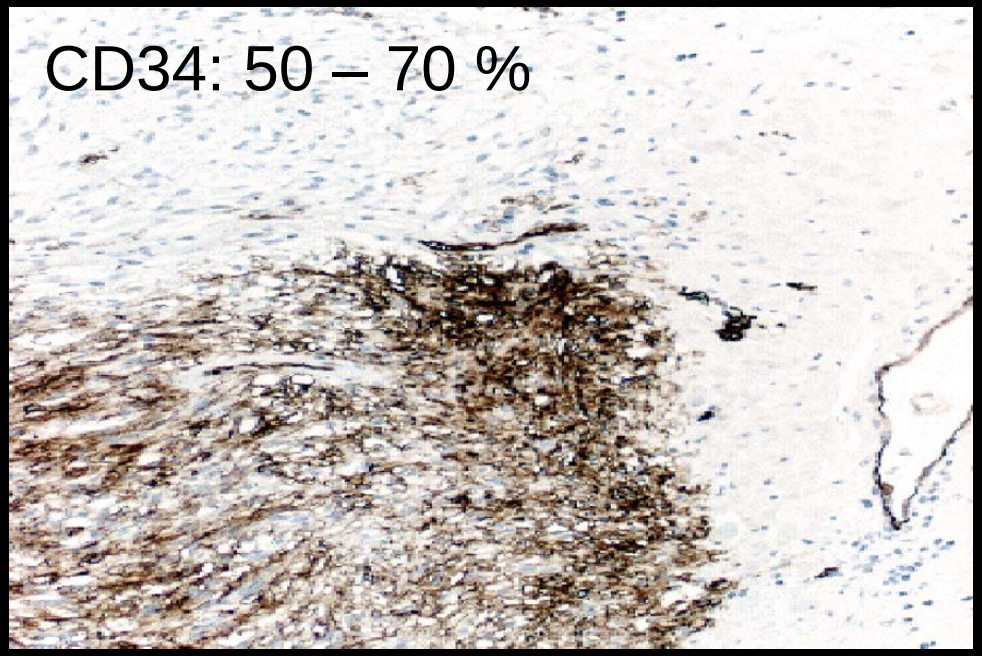
GIST – Histology

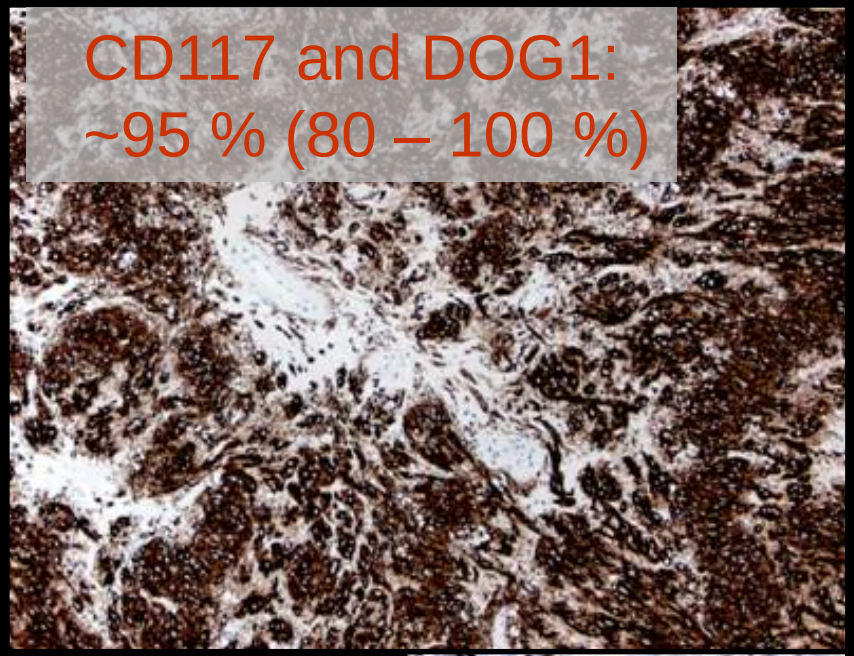
- Storiform (~ MFH)
- Pallisading (~ scwannoma)
- Organoid (~ carcinoid)

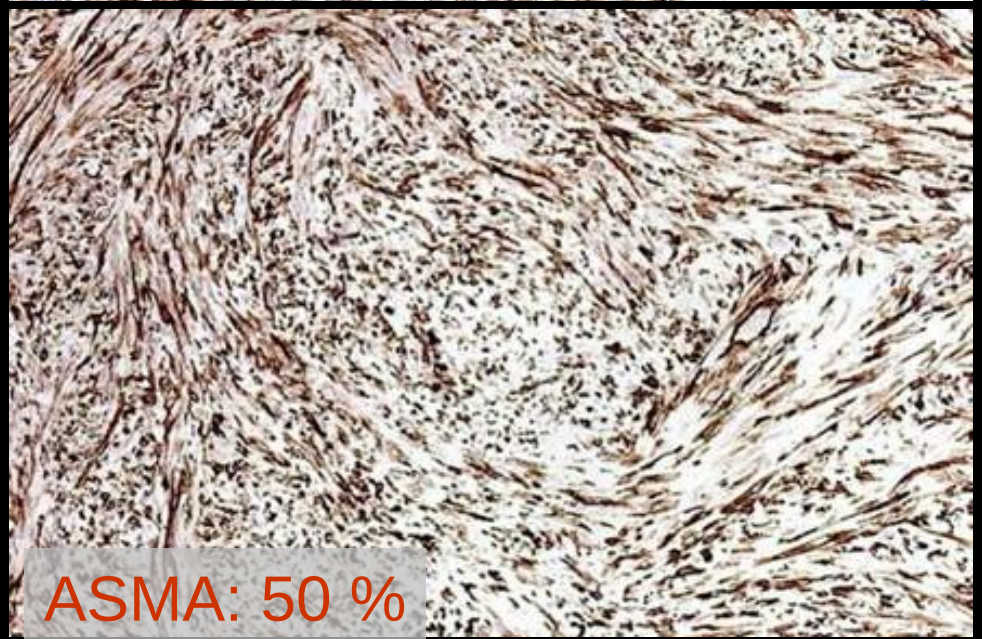


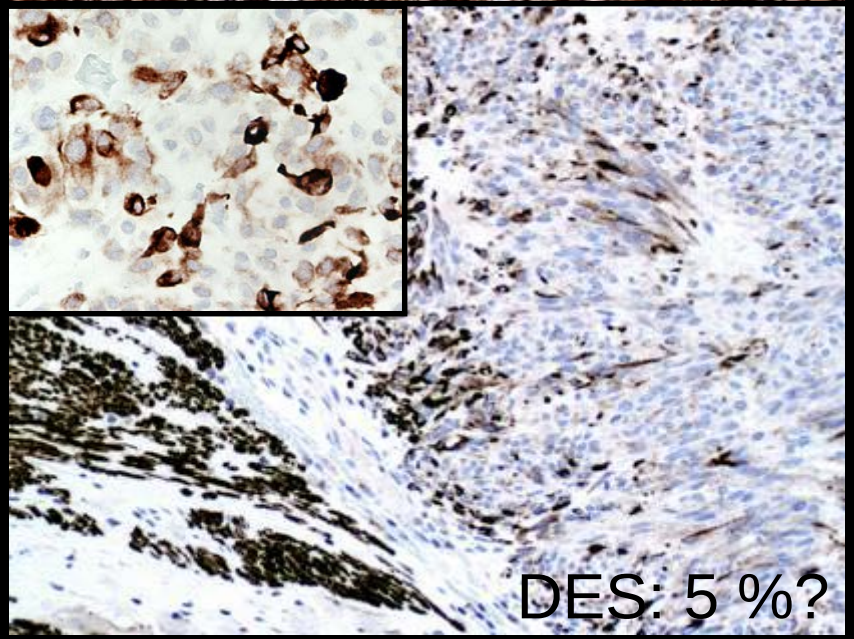


GIST – Immunohistochemistry

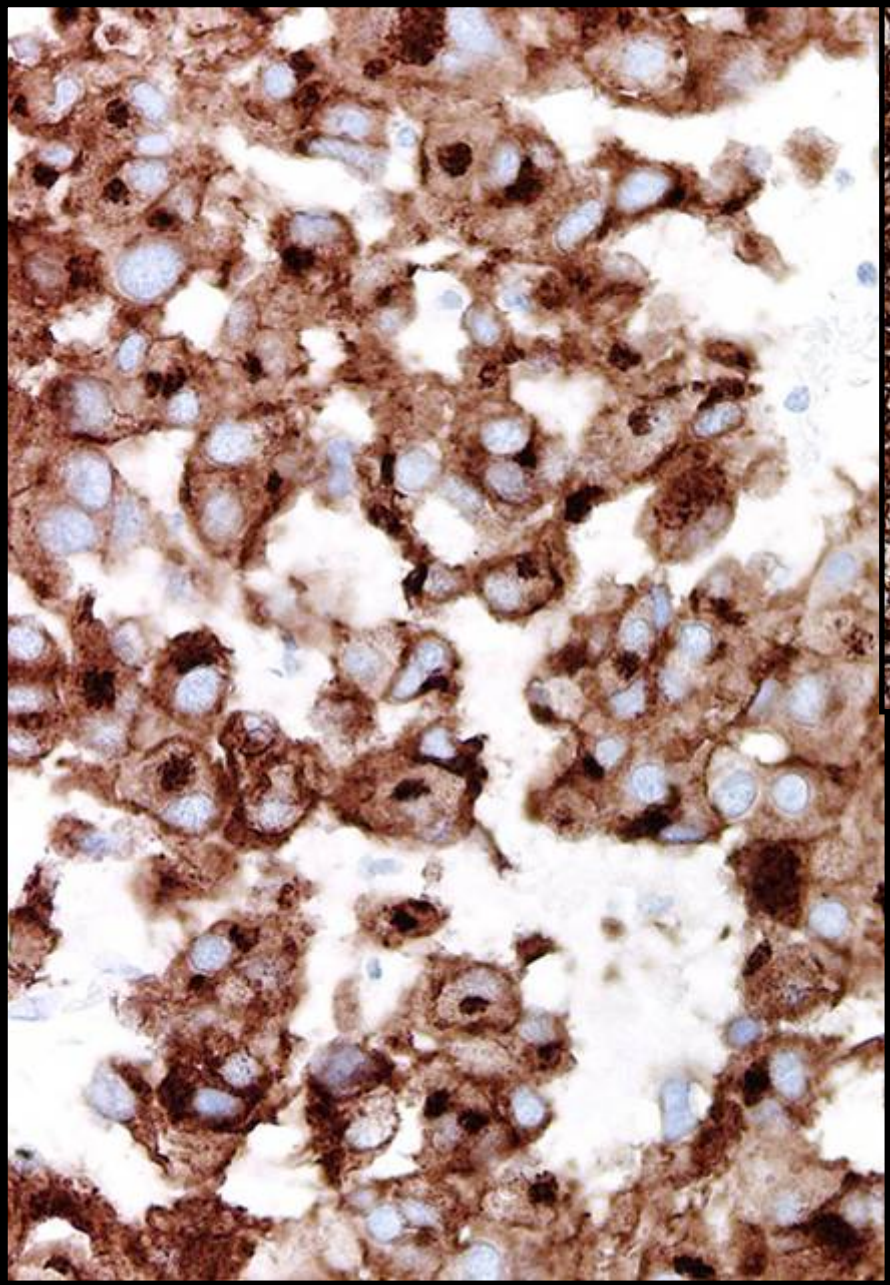


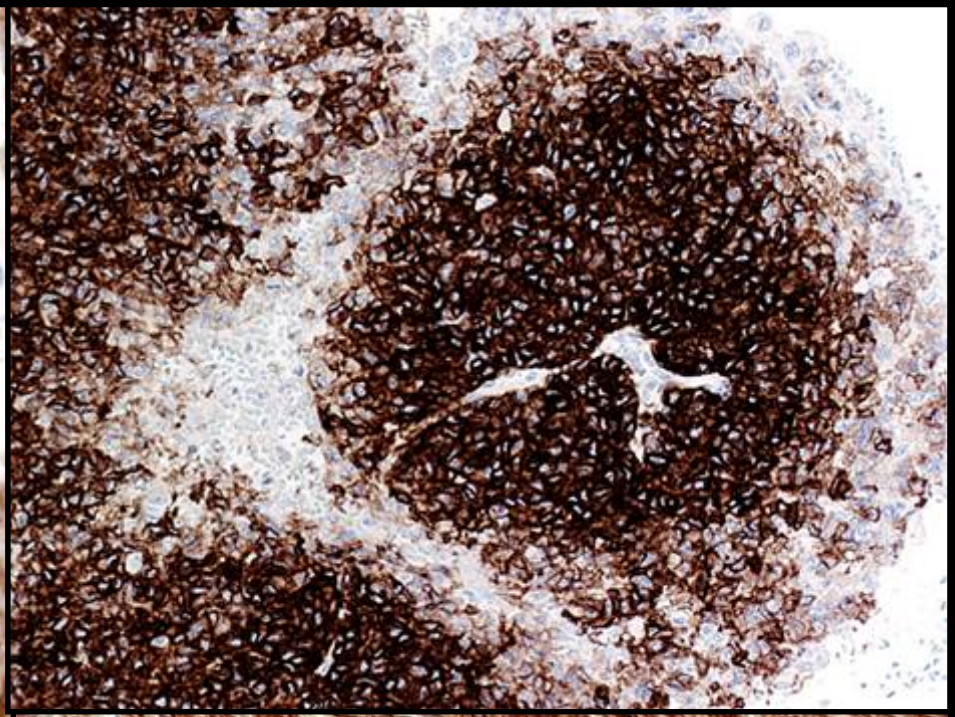


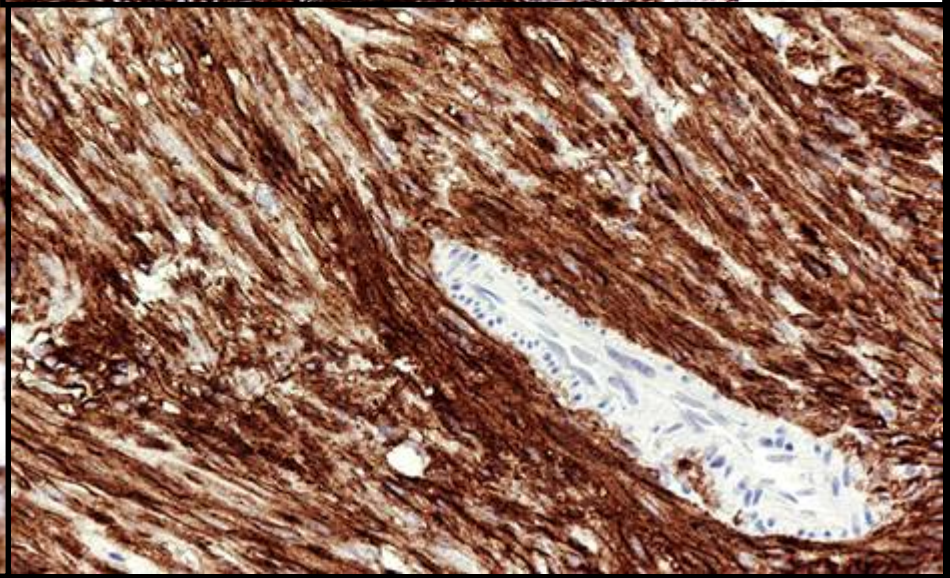




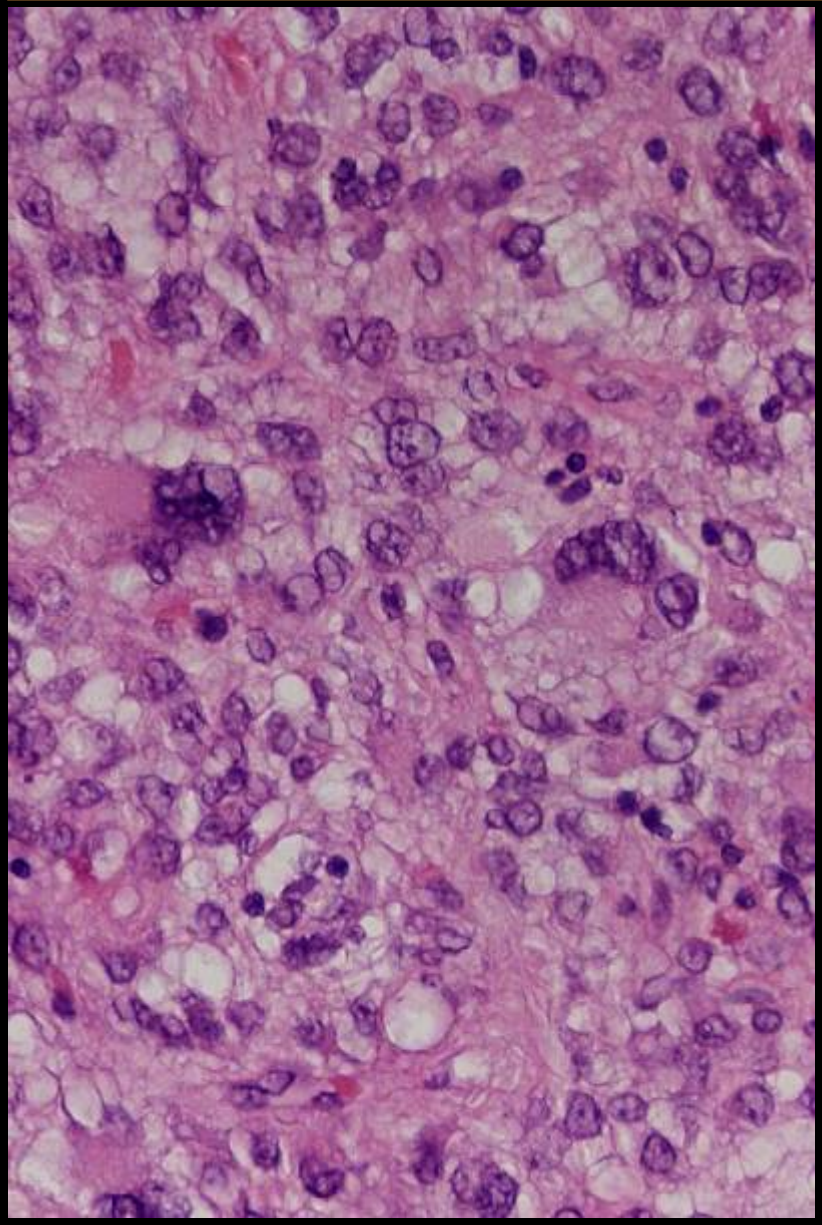
GIST – CD117 patterns



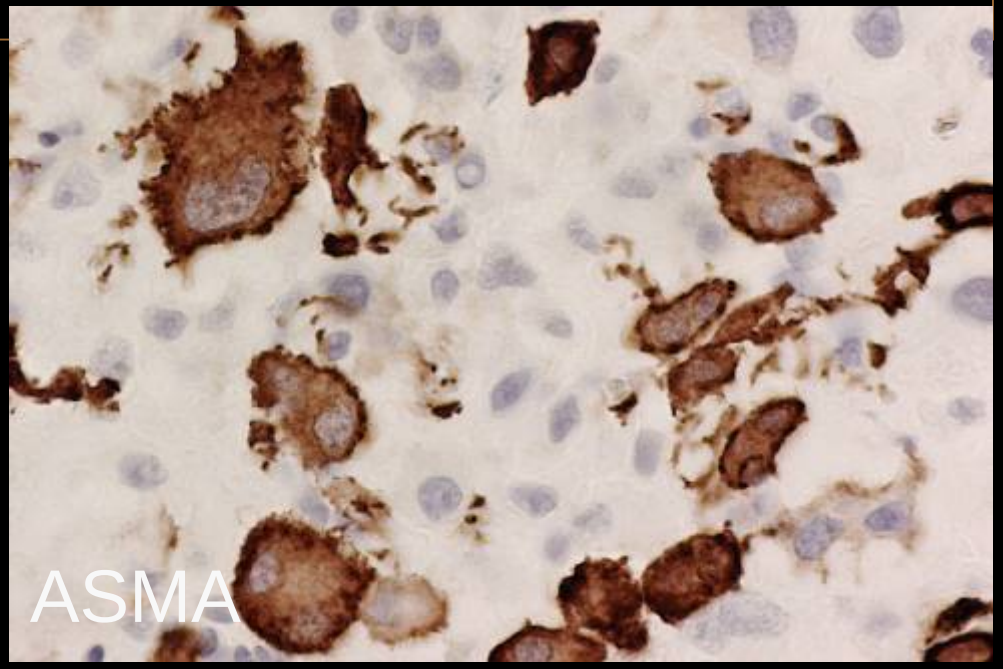


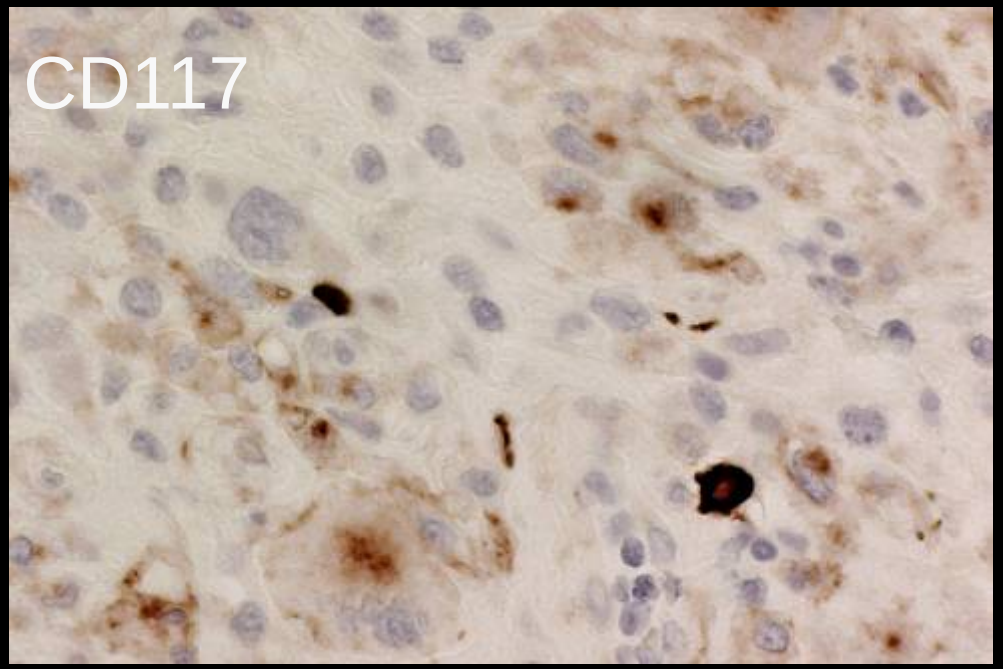


Epithelioid GIST



PDGFR-a mutation

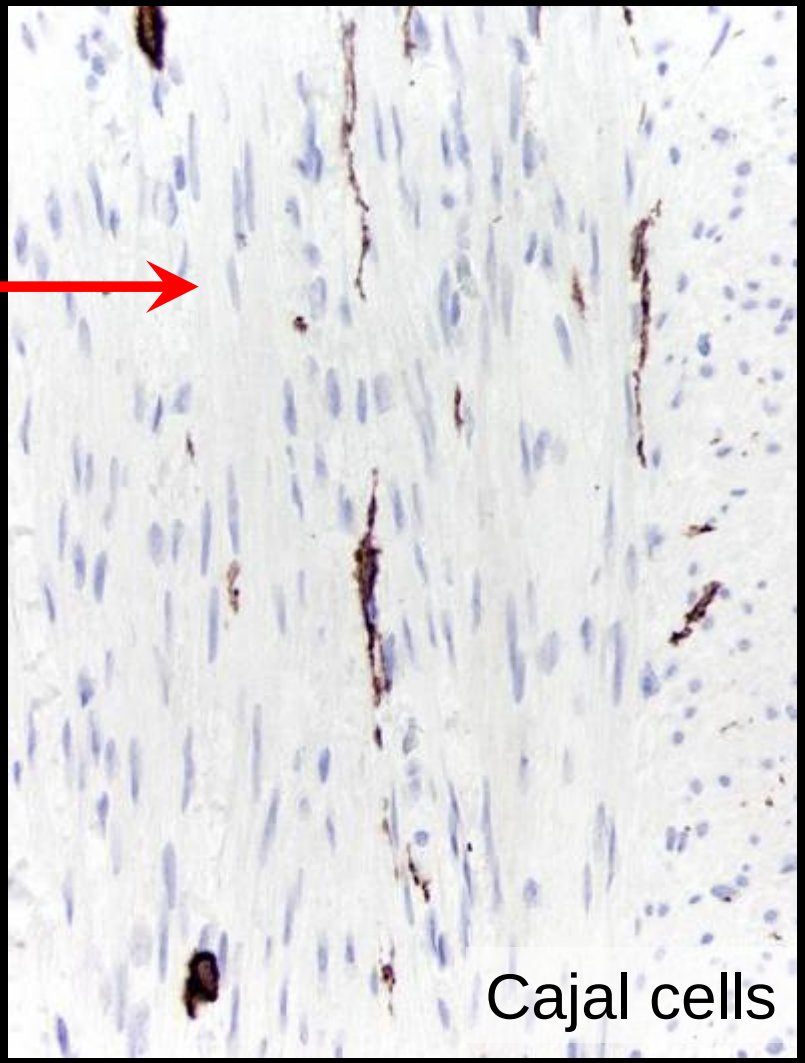




CD117

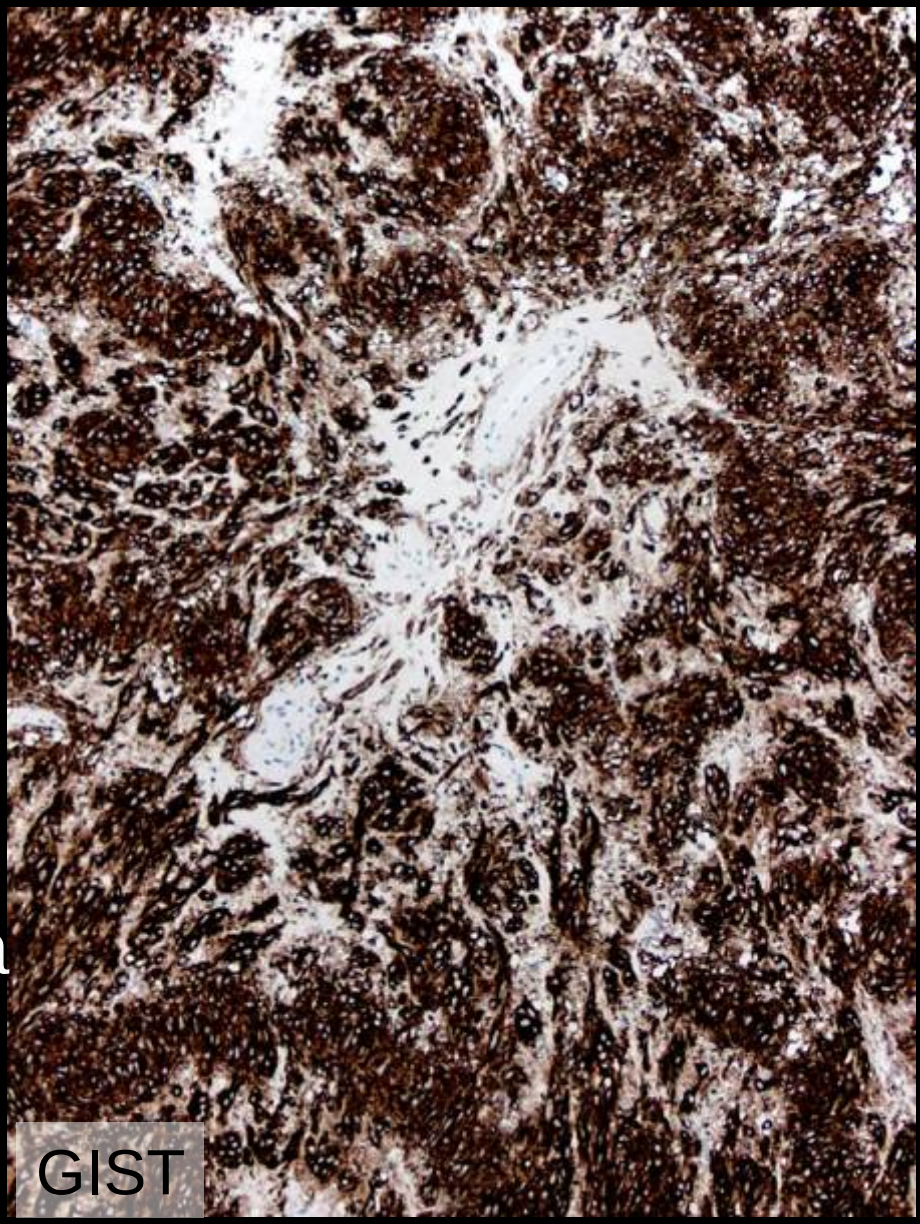
Cell membrane protein encoded by the c-kit proto-oncogene, a tyrosine kinase growth factor receptor for stem cell factor, required for the development and growth of CD117 expressing cells.

- Mast cells
- Melanocytes
- Interstitial cells of Cajal
- Various epithelia
- Testicular/ovarian interstitial cells
- Neurons of CNS
- Immature myeloid cells
- Trophoblastic cells,
- Foetal endothelial cells
- Foetal basal cells of the skin



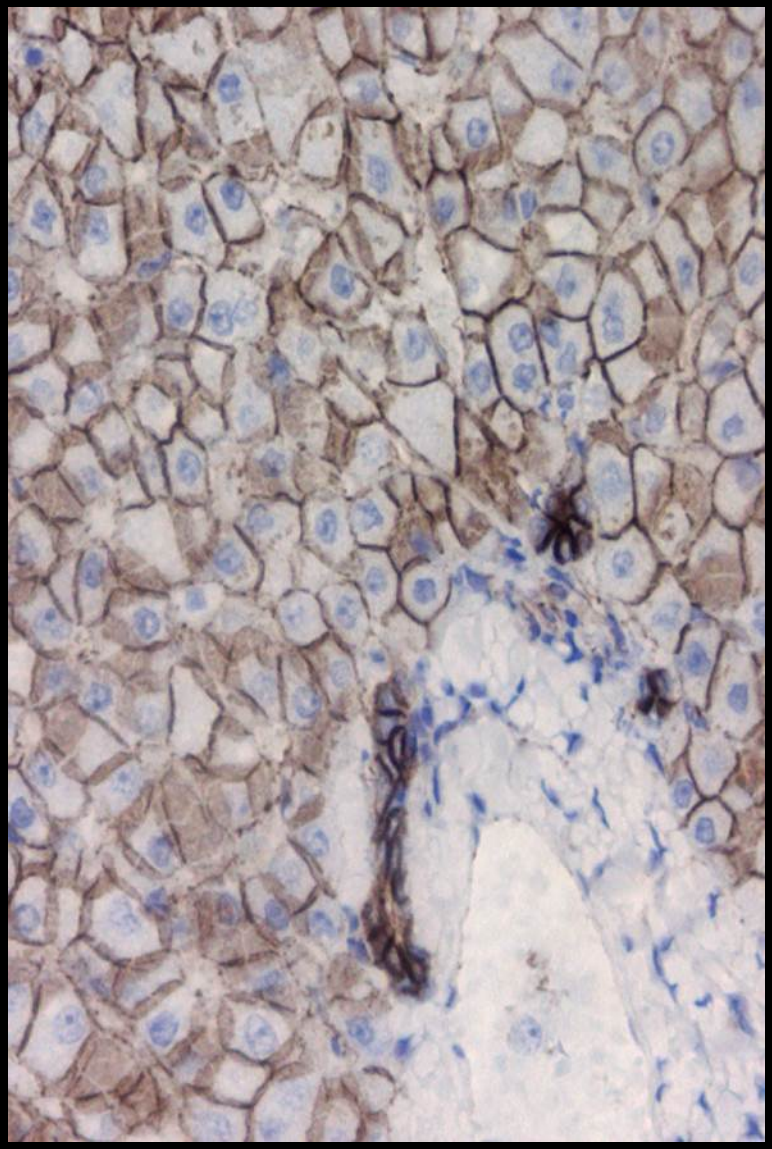
CD117 in neoplasms

- GIST
- Mast cell neoplasms
- Seminoma
- Malignant melanoma
- Synovial sarcoma
- Carcinomas
- Neuroblastoma
- Acute myeloid leukaemia
- Malignant lymphomas

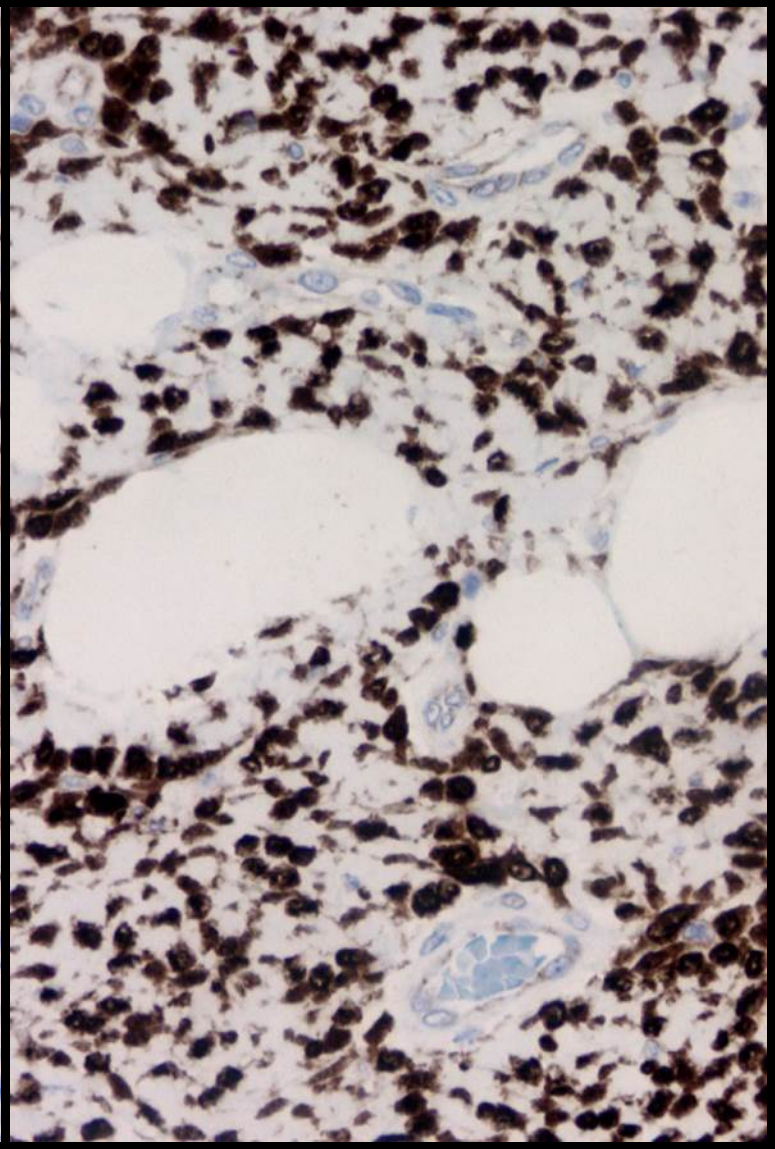


GIST

β-catenin



Membrane reaction – normal cells



Nuclear reaction – mutated cells (desmoid)

International Symposium on Immunohistochemistry

January 4th - 7th, 2018

Hosted by Dept. of Histopathology, Tata Medical Center, Kolkata, India

In collaboration with NordiQC, Alborg, Denmark and ISIMM, California, USA

Diagnostic IHC in GI and liver pathology

Thank you
for your attention

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