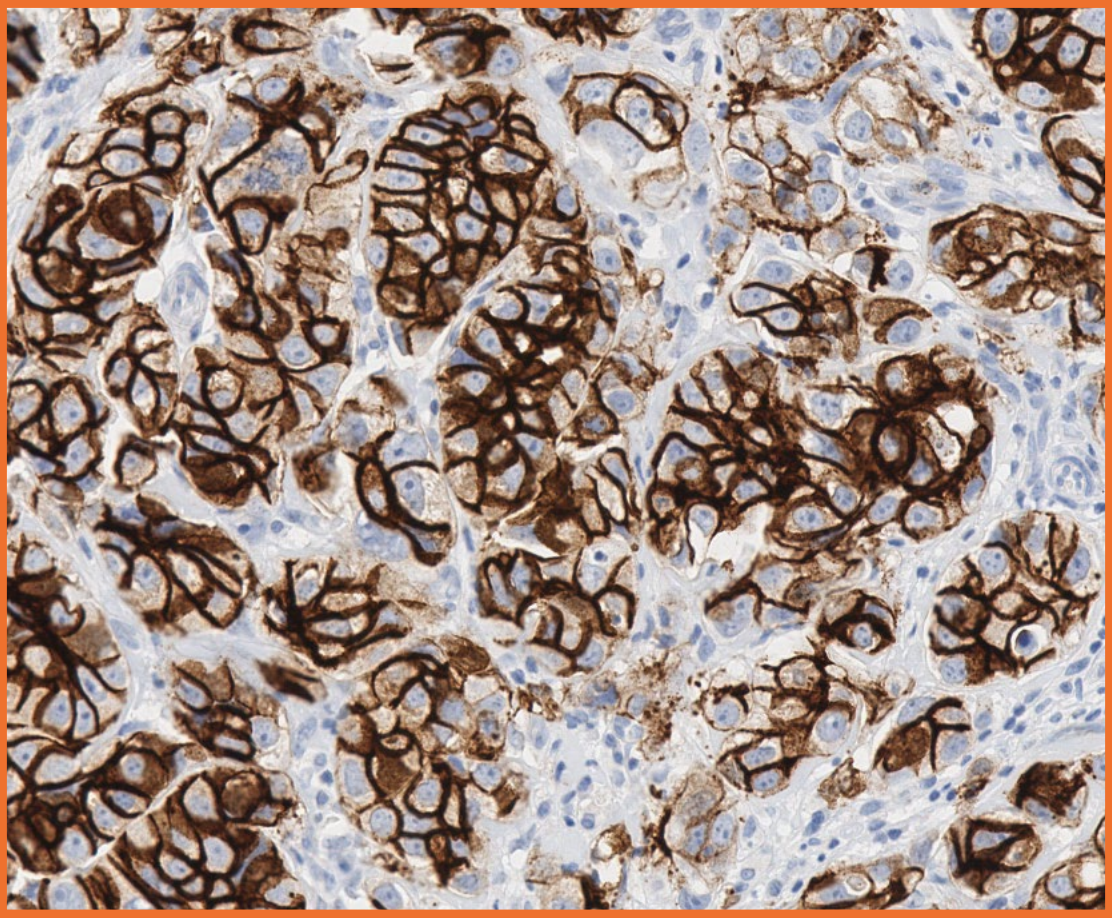
Enhanced validation data

Anti-ErbB2 / HER2 recombinant antibody – ab134182



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Enhanced validation of Anti-ErbB2 / HER2 recombinant antibody [EP1045Y] – ab134182

Enhanced validation designed for your needs

We understand the challenge of finding the right antibody clone – highly specific and sensitive to your intended target – at early selection stages of your development program. To de-risk this clone selection process for you, we generated enhanced validation data for our best recombinant antibody clones to some of the most promising targets.

Our enhanced validation gives you an extra level of confidence in an antibody clone

— Provides additional data on the specificity and sensitivity of our recombinant antibodies in immunohistochemistry (IHC) and other relevant techniques

— Carried out in a custom manner, specific both to the target and the relevant research and clinical settings

— Builds upon our high-quality standard validation

Our framework for enhanced validation

— Our enhanced validation focuses on generating detailed IHC expression profiles for promising oncology targets in selected formalin-fixed paraffin-embedded (FFPE) human normal tissues and cancer tissue microarrays (TMAs).

— In this study, we demonstrate the sensitivity and specificity of Anti-ErbB2 / HER2 antibody (ab134182) in IHC in selected TMAs and cell lines using a DISCOVERY ULTRA system (Roche Diagnostics) and a BOND™ RX Research Stainer (Leica®).

— A multiplex (duplex) assay was also developed using the DISCOVERY ULTRA system (Roche Diagnostics).

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Target overview

HGNC symbol / Alias symbols
ERBB2 / HER2

Approved name / Alias name
Erb-b2 receptor tyrosine kinase 2 / human epidermal growth factor receptor 2

Chromosomal location
17q12

Function

- Regulates cell growth, survival, differentiation and therapeutic resistance[1].
- HER2 signaling promotes epithelial–mesenchymal transition (EMT) and facilitates cancer cell invasion and metastasis[2].
- HER2-positive breast cancer is associated with a higher risk of metastasis[3,4].

Tissue specificity

- Amplification or overexpression of the HER2 gene occurs in approximately 15–30% of breast cancers[5].
- HER2 overexpression also occurs in gastric, ovarian, colon, bladder, lung, head and neck, and esophagus cancers, and uterine serous endometrial carcinoma[6-13].

Cellular localization

- Cell membrane

Target information above in part from: UniProt accession P04626
The UniProt Consortium
The Universal Protein Resource (UniProt) in 2010
Nucleic Acids Res. 38:D142-D148 (2010)

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Materials and methods

Human tissues were selected based on the target's expression and its current relevance to ongoing research and clinical trials. Gene expression was further analyzed for oncology targets in cBioPortal for Cancer Genomics using the Cancer Genome Atlas (TCGA) PanCancer Atlas datasets[14-17].

Tissue microarray (TMA)	Cores	Cases	Normal/ Benign cases	Cancer cases	Source (#catalog number)
Multi-normal[(a)]	40	37	37	0	In-house TMA
Multi-normal	34	33	33	0	Pantomics (#MN0341)
Multi-cancer[(b)]	40	35	1	34	In-house TMA
Breast cancer	150	70	5	70	Pantomics (#BRC1502)
Stomach cancer	102	102	5	97	Pantomics (#STC1021)
Bladder cancer	102	102	5	97	Pantomics (#BLC1021)
Nasopharyngeal cancer	150	96	6	131	Pantomics (#PAC1021)

Table 1. List of human TMAs used in the enhanced validation. All tissues were sourced from Abcam-approved tissue suppliers.

a) The multi-normal TMA consists of the following tissues from two donors: colon, cerebellum, small intestine mucosa, tonsil, stomach, testis, prostate, lung, skeletal muscle, breast, heart, skin, endometrium, spleen, pancreas, lymph node, kidney. The placenta and liver were from a single donor.

b) The multi-cancer TMA consists of the following tissues from two donors: seminoma, prostate adenocarcinoma, bladder carcinoma, renal cell carcinoma, melanoma, stomach adenocarcinoma, pancreatic adenocarcinoma, hepatocellular carcinoma, ovarian carcinoma, cervical cancer, head and neck carcinoma, and endometrial cancer. The following tissues were from single donors: lung (squamous cell carcinoma (SCLC) and non-squamous cell carcinoma (NSCLC)), colon (adenocarcinoma and invasive adenocarcinoma), breast (ductal carcinoma and invasive lobular carcinoma), B-cell lymphoma, T-cell lymphoma, gliomas (grade II and IV) and placenta.

Step	Reagents	Method
Deparaffinization	DISCOVERY Wash (RUO)	Standard
Cell conditioning	ULTRA Cell Conditioning Solution (ULTRA CC1)	64 min, 100°C
Pre-primary peroxidase inhibitor	OptiView Peroxidase Inhibitor	4 min
Primary antibody	Anti-ErbB2 / HER2 antibody [EP1045Y] – ab134182 diluted in Bond™ primary antibody diluent (#AR9352) to final concentration of 0.75 µg/mL	16 min, 37°C
Counterstain	Hematoxylin II	8 min
Post counterstain	Bluing Reagent	4 min

Table 2 . IHC staining protocol on the DISCOVERY ULTRA (Roche Diagnostics) instrument. Staining was performed using standard conditions with OptiView DAB IHC Detection kit (#760-700).

Enhanced validation data

Step	Reagents	Method
Deparaffinization	DISCOVERY Wash (RUO)	Standard
Cell conditioning	ULTRA Cell Conditioning Solution (ULTRA CC1)	64 min, 95°C
DISC inhibitor	DISCOVERY Inhibitor (#760-4840)	8 min
1st Primary antibody	Anti-MUC4 antibody [EPR27199-56] – ab307546 diluted in Bond™ primary antibody diluent (#AR9352) to final concentration of 1.5 µg/mL	16 min, 37°C
1st Linking antibody	DISCOVERY Anti-Rb HQ (#760-4815)	12 min, 37°C
1st Enzyme conjugate	DISCOVERY Anti-HQ HRP (#760-4820)	12 min
1st HRP-driven chromogen	DISCOVERY Purple kit (RUO) (#760-229)	12 min
Dual sequence antibody denaturation	ULTRA Cell Conditioning Solution (ULTRA CC2)	8 min, 100°C
2nd Primary antibody	Anti-ErbB2 / HER2 antibody [EP1045Y] - ab134182 diluted in Bond™ primary antibody diluent (#AR9352) to final concentration of 1.0 µg/mL	16 min, 37°C
2nd Linking antibody	DISCOVERY Anti-Rb HQ (#760-4815)	12 min, 37°C
2nd Enzyme conjugate	DISCOVERY Anti-HQ HRP (#760-4820)	12 min
2nd HRP driven chromogen	DISCOVERY Teal kit (RUO) (#760-247) Teal HRP H202	4 min
	DISCOVERY Teal kit (RUO) (#760-247) Teal HRP Act	12 min
Counterstain	N/A	-

Table 3. Duplex IHC staining protocol on the DISCOVERY ULTRA (Roche Diagnostics) instrument. Staining was performed using standard conditions with DISCOVERY Purple kit (RUO) (#760-229) and DISCOVERY Teal HRP kit (#760-247). These translucent chromogens shift in color when both are present in the same cell and sub-cellular compartment. Co-localized DISCOVERY Purple and DISCOVERY Teal combine to form an indigo-blue-to-deep-purple color.

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Step	Reagents	Method
Dewax	Bond™ dewax solution (AR922), alcohol, BOND wash solution (AR9590)	Dewax
Antigen retrieval	Bond™ epitope retrieval ER1 solution (AR9961)	HIER with ER1 (pH 6), 20 min, 100°C

Step	Reagents	Number of washes	Time (minutes)
Peroxide block	3-4% (v/v) Hydrogen peroxide	-	5
Wash	Bond™ wash solution	3x	0
Primary antibody	Anti-ErbB2 / HER2 antibody [EP1045Y] - ab134182 diluted in Bond™ primary antibody diluent (#AR9352) to final concentration of 1 µg/mL	-	15
Wash	Bond™ wash solution	4x	0
Secondary antibody	Bond™ polymer refine detection (DS9800)	-	8
Wash	Bond™ wash solution	2x	4
	Deionized water	1x	0
Visualization	Mixed DAB refine (DS9800)	1x	0
	Mixed DAB refine (DS9800)	-	10
Wash	Deionized water	3x	0
Counterstain	Hematoxylin (DS9800)	-	5
Wash	Deionized water	1x	0
	Bond™ wash solution	1x	0
	Deionized water	1x	0

Table 4. IHC staining protocol on BONDTM RX Research Stainer (Leica®). The protocol used is the same as the default IHC protocol F on BOND™ RX Research Stainer (Leica®), apart from the standard post-primary step, which has been excluded from our protocol. All steps were performed at room temperature.

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Evaluation of staining intensity

HER2 staining intensity was analyzed manually according to the 2023 ASCO/CAP guidelines[18,19].

IHC score	IHC staining pattern
0	No staining is observed or membrane staining that is incomplete and is faint/barely perceptible and in ≤ 10% of tumor cells.
1+	Incomplete membrane staining that is faint/barely perceptible and in >10% of tumor cells.
2+	Weak to moderate complete membrane staining observed in >10% of tumor cells.
3+	Circumferential membrane staining that is complete, intense in >10% of tumor cells.

Table 5. IHC intensity scoring. The scoring criteria applied for the analysis of IHC staining with anti-ErbB2 / HER2 antibody (ab134182).

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HER2 expression in FFPE cell pellets (DISCOVERY ULTRA)

Below are the representative images of HER2 expression in *ERBB2* wild-type and knock-out FFPE MCF7 (human breast adenocarcinoma cancer) cells (ab286260). HER2 was detected in the wild-type cell line and absent in the knock-out cell line.

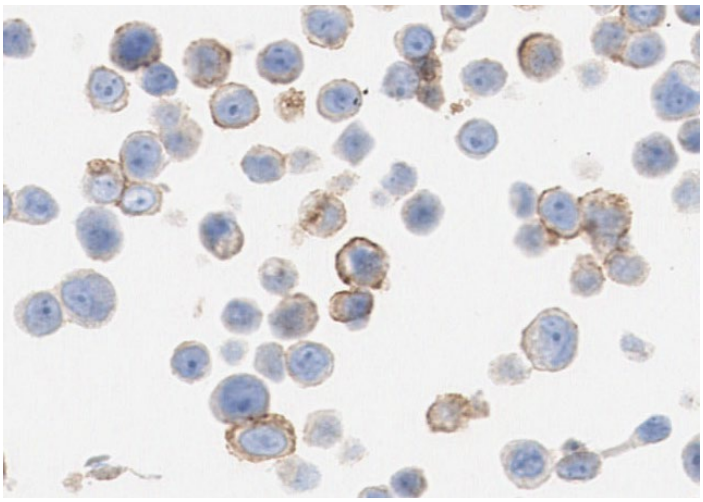
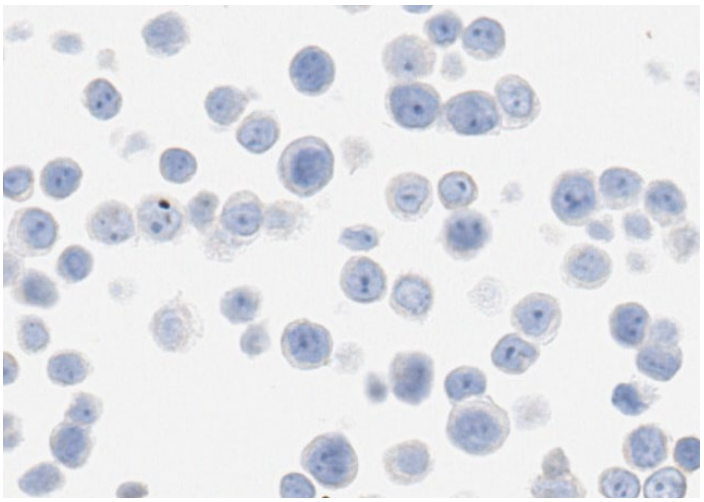
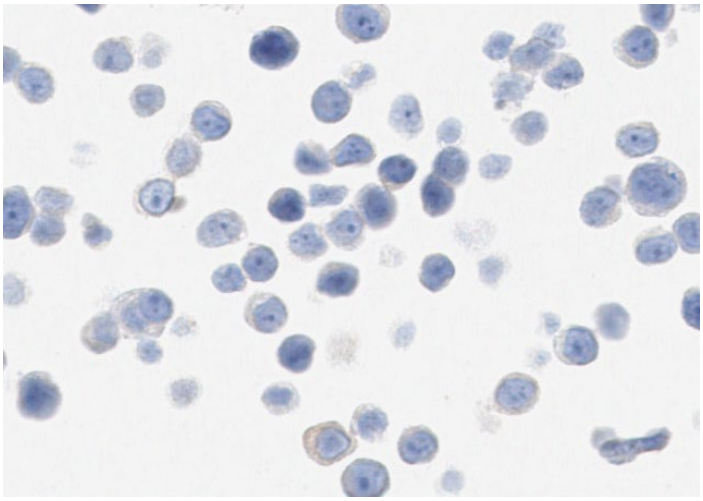
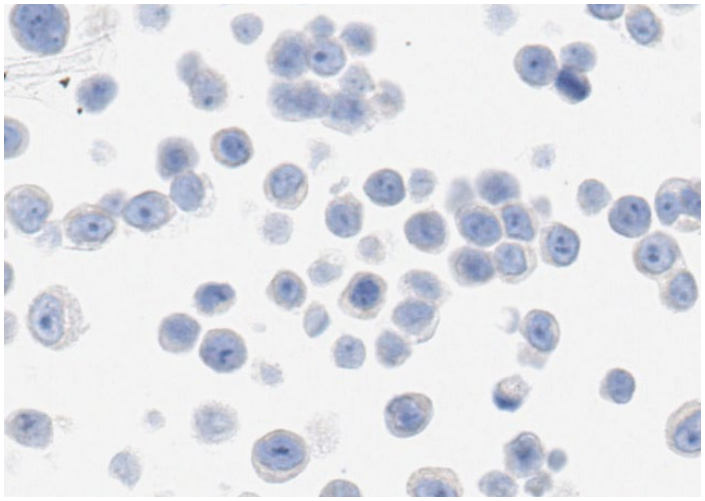
	FFPE MCF7$^{ERBB2+/+}$	**FFPE MCF7$^{ERBB2-/-}$**
HER2		
Isotype control		

Figure 1. HER2 expression in wild-type and knock-out MCF7 cell line. IHC staining of FFPE MCF7$^{ERBB2+/+}$ and MCF7$^{ERBB2-/-}$ cell lines (ab286260) using anti-ErbB2 / HER2 (ab134182) or anti-rabbit IgG-isotype control antibody (ab172730). Positive staining in brown; nuclear hematoxylin counterstain in blue. Slides were scanned at 40x on Aperio® AT2 and imaged at 40x on Aperio® ImageScope.

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HER2 expression in cancer (DISCOVERY ULTRA)

HER2 expression varied in the analyzed cancer TMAs. Breast cancer had the highest number of cases showing 3+ staining, whereas nasopharyngeal cancer had the highest number of cases with no staining. The staining intensity of cohorts of cancer subtypes was also evaluated separately in scatter plots (Figure 3).

IHC score	Breast cancer (66 cases)	Stomach cancer (91 cases)	Bladder cancer (82 cases)	Nasopharyngeal cancer (119 cases)
0	16	62	36	107
1+	15	19	20	11
2+	11	5	18	1
3+	24	5	8	0

Table 6. Frequency of IHC intensity scoring in cancer TMAs. Individual case scoring is segregated into relevant IHC scoring intensity bands.

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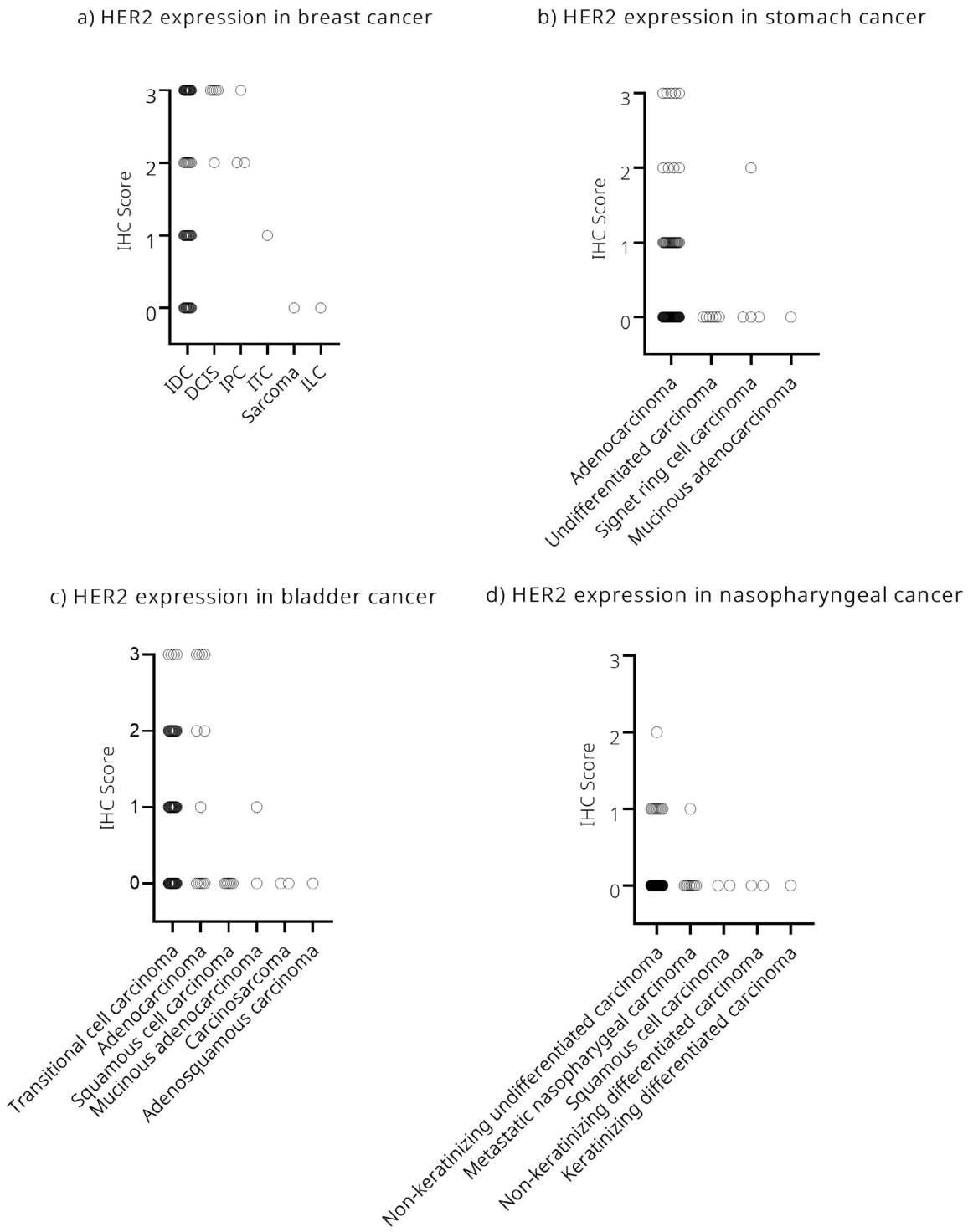


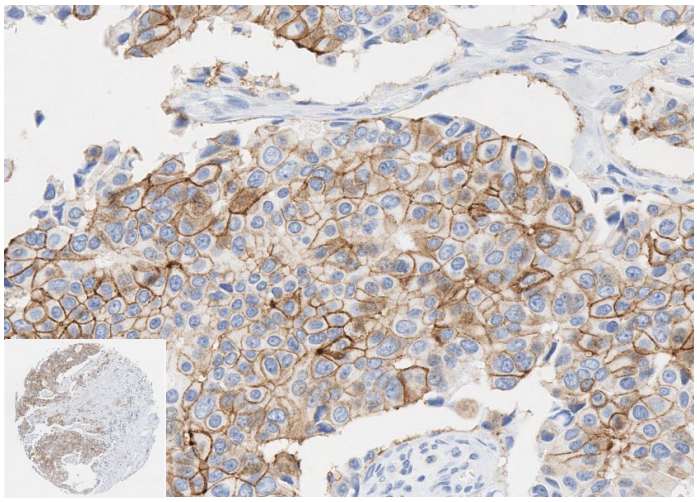
Figure 2. HER2 protein expression in selected cancer TMAs.
(a) Average HER2 IHC score from 66 cases of breast cancer in duplicate; invasive ductal carcinoma (IDC) 54, ductal carcinoma in situ adenocarcinoma (DCSI) (6), invasive papillary carcinoma (3), invasive lobular carcinoma (1), invasive tubulo-lobular carcinoma (ITC) (1), sarcoma (1).
(b) HER2 IHC score from 91 cores/cases of stomach cancer; adenocarcinoma (80), undifferentiated carcinoma (6), signet ring cell carcinoma (4) and mucinous adenocarcinoma (1).
(c) HER2 IHC score from 82 cores/cases of bladder cancer; transitional cell carcinoma (59), adenocarcinoma (12), squamous cell carcinoma (6), mucinous adenocarcinoma (2), carcinosarcoma (2) and adenosquamous carcinoma (1).
(d) HER2 IHC score from 119 cores/cases of nasopharyngeal carcinoma (NPC); non-keratinizing undifferentiated carcinoma (105), metastatic NPC (9) squamous cell carcinoma (2) non-keratinizing differentiated carcinoma (2) keratinizing differentiated carcinoma (1).

HER2 expression in breast cancer (DISCOVERY ULTRA)

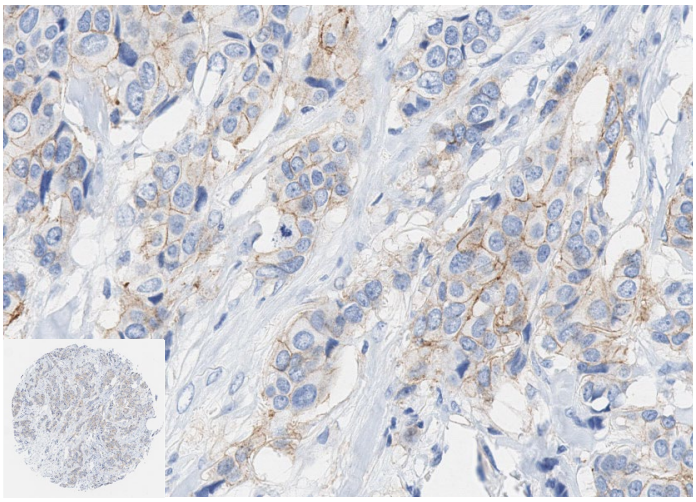
Below are the representative images of HER2 expression in individual cases of each analyzed breast cancer subtype. Immunohistochemical staining patterns varied from no expression (0) to strong expression (3+).

HER2

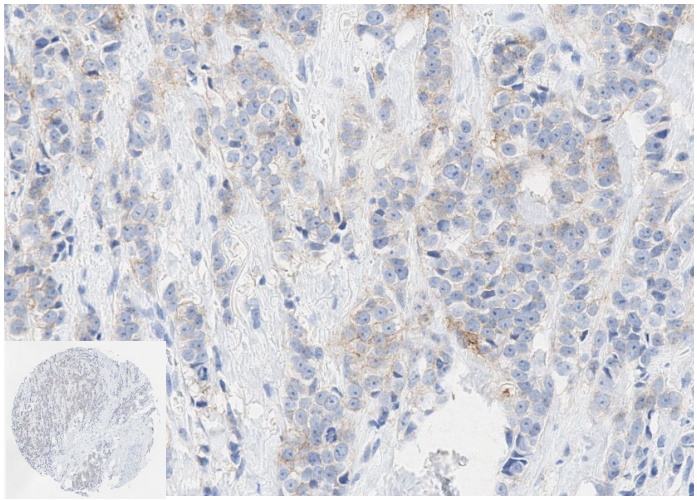
IDC, Grade II-III (2+)



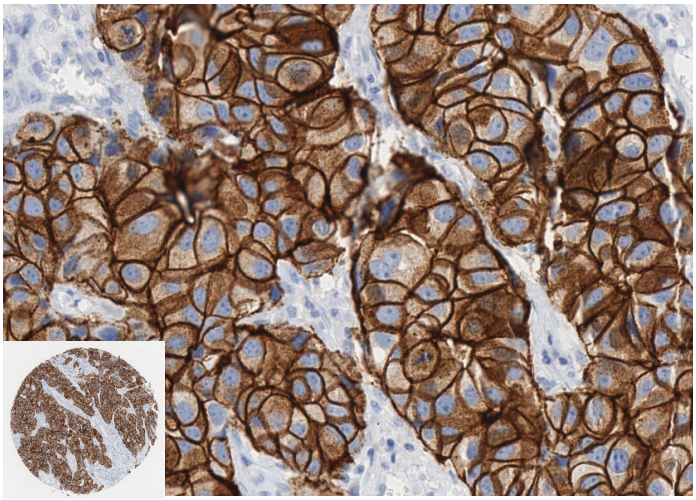
IDC, Grade II-III (1+)



IDC, Grade II-III (0)



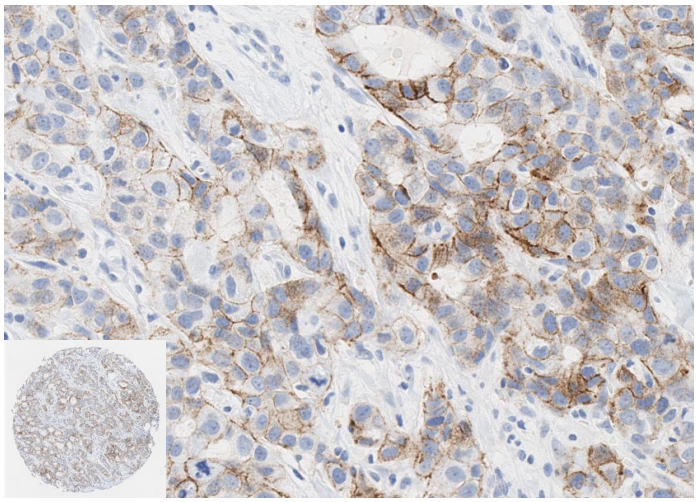
IDC, Grade II (3+)



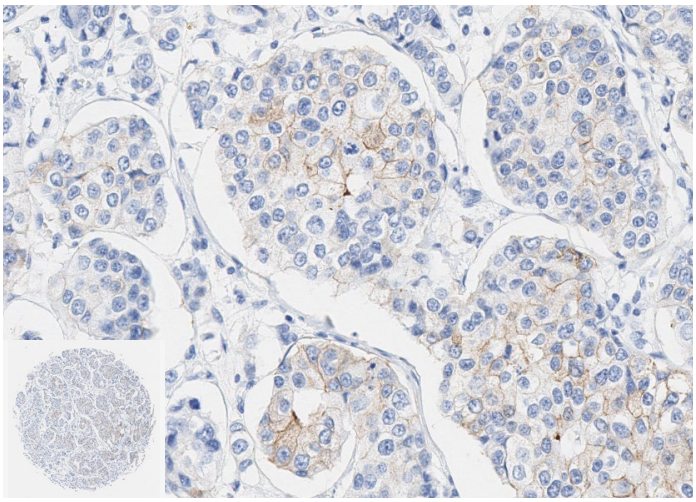
Enhanced validation data

HER2

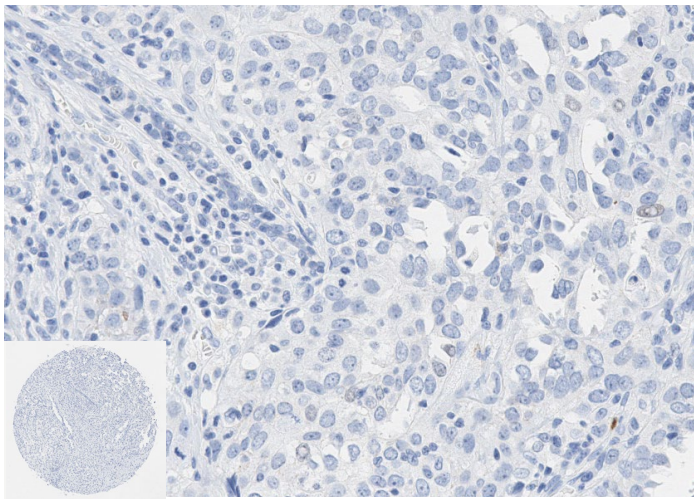
IDC, Grade II (2+)



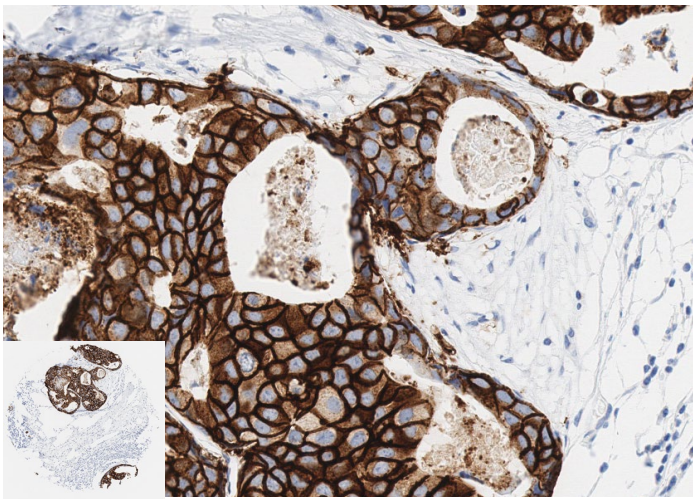
IDC, Grade II (1+)



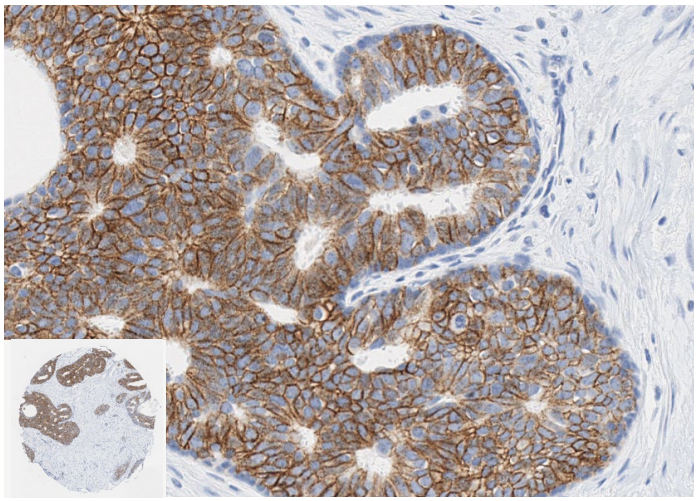
IDC, Grade I (0)



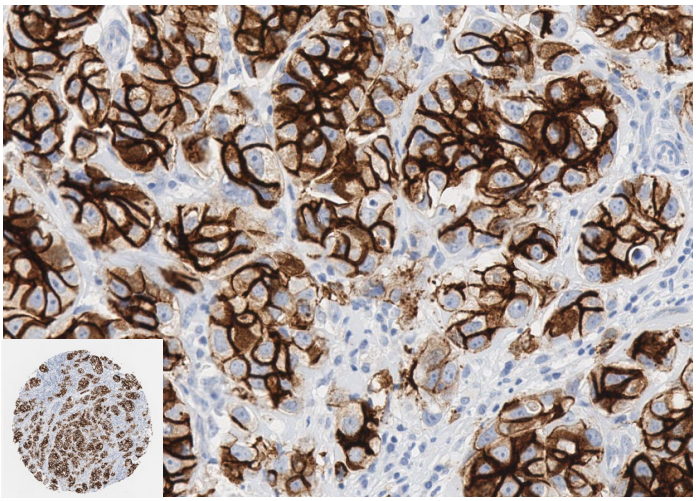
DCIS, Grade I (3+)



DCIS, Grade I (2+)

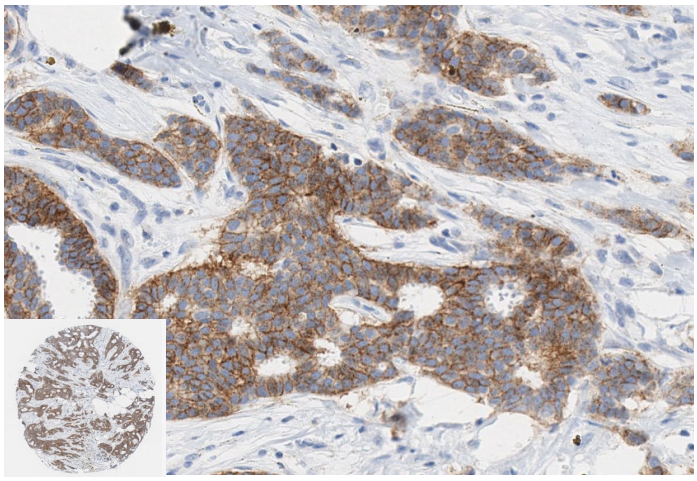


IPC, Grade II-III (3+)

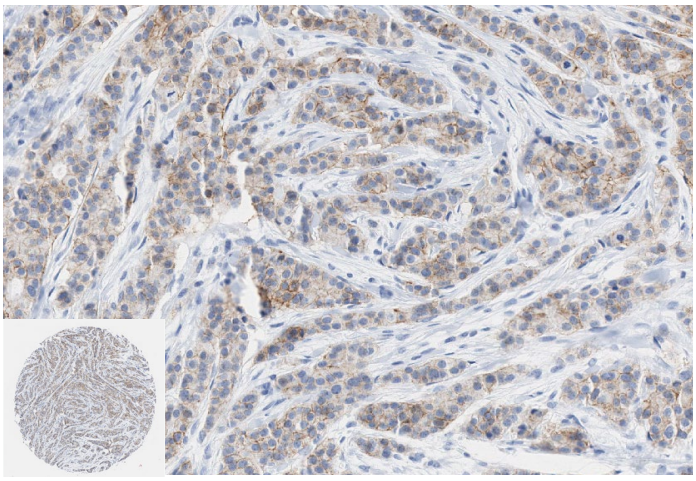


HER2

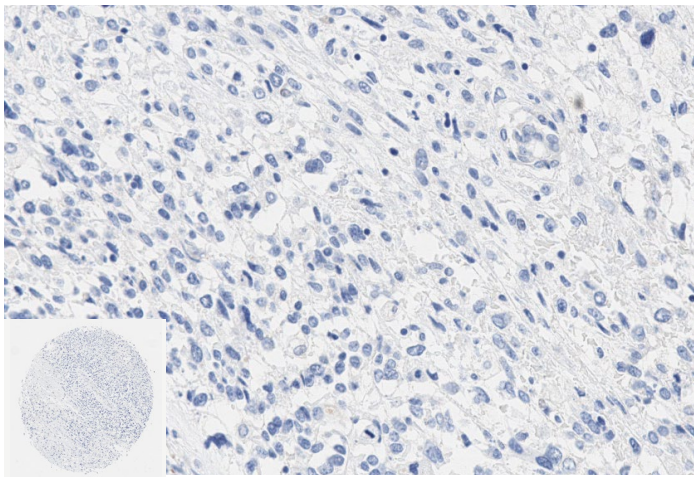
IPC, Grade I-II (2+)



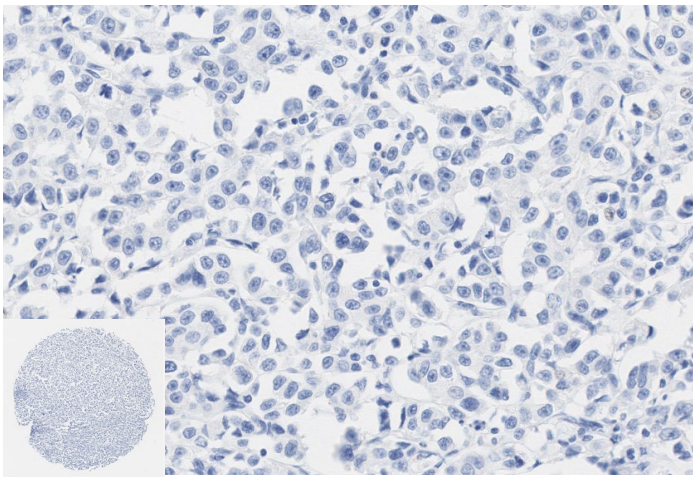
ITC, Grade II-III (1+)



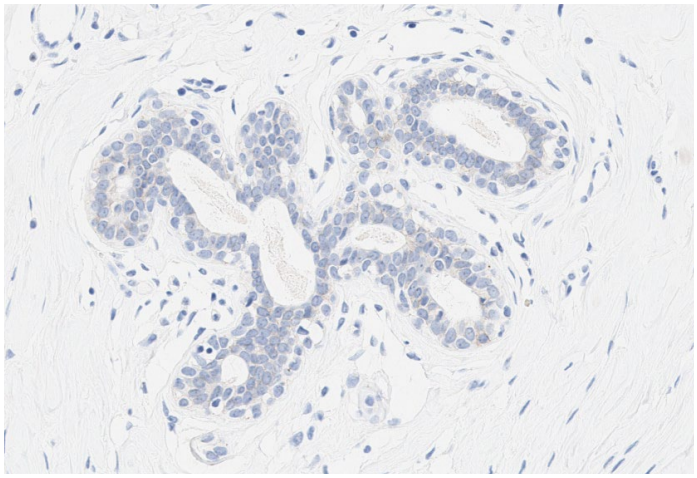
Sarcoma, (0)



ILC, Grade II-III (0)



Normal breast (0, HER2)



Normal breast (**isotype control**)

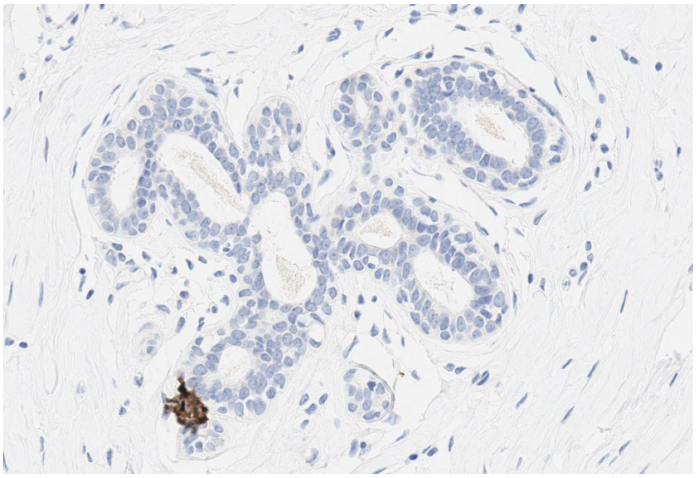


Figure 3. HER2 expression in breast cancer. IHC images show HER2 staining in brown; nuclear hematoxylin counterstain in blue. Slides were scanned at 20x (whole core insets at 5x) on Aperio® AT2 and imaged at 20x on Aperio® ImageScope.

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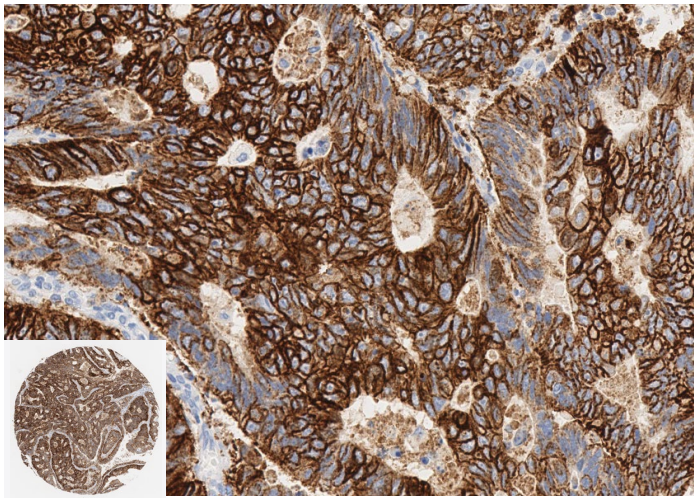
HER2 expression in stomach cancer (DISCOVERY ULTRA)

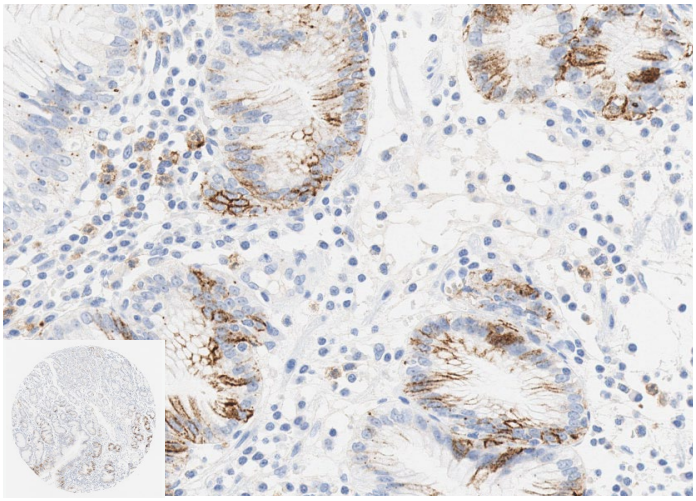
Below are representative images of individual cases of stomach cancer, showing no (0) to strong (3+) HER2 expression.

HER2

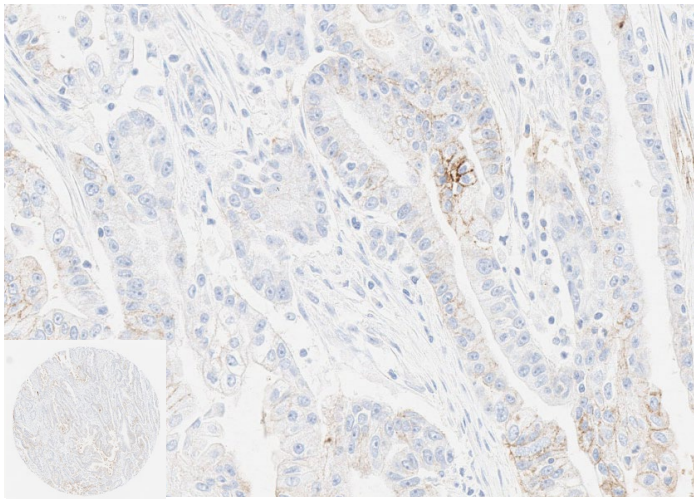
Adenocarcinoma, Grade III (3+)



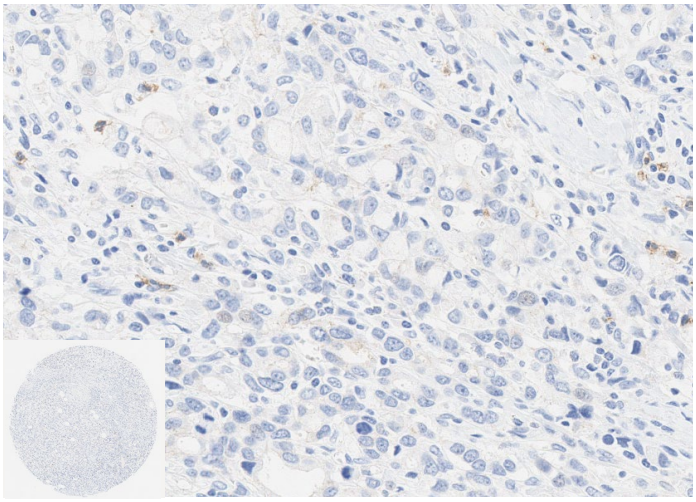
Adenocarcinoma, Grade II (2+)



Adenocarcinoma, Grade II (1+)



Adenocarcinoma, Grade II (0)



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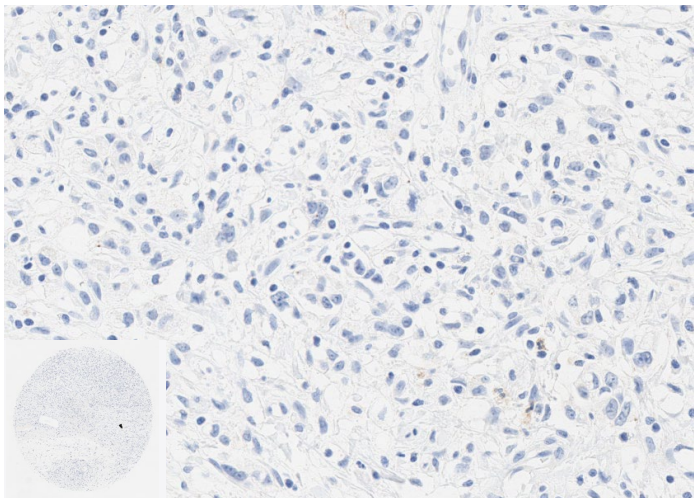
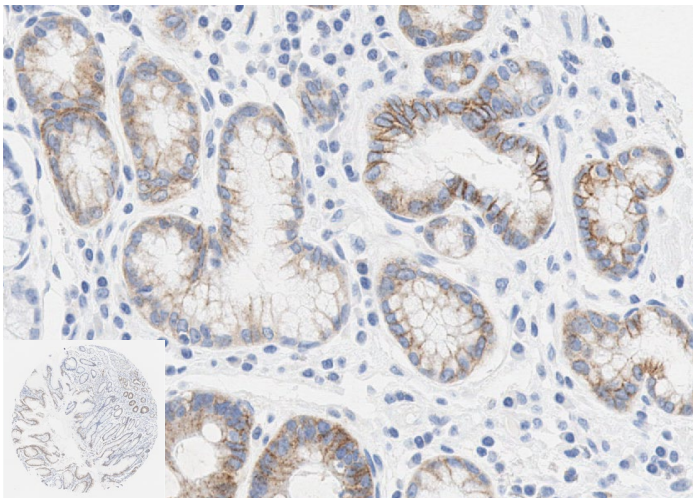
HER2

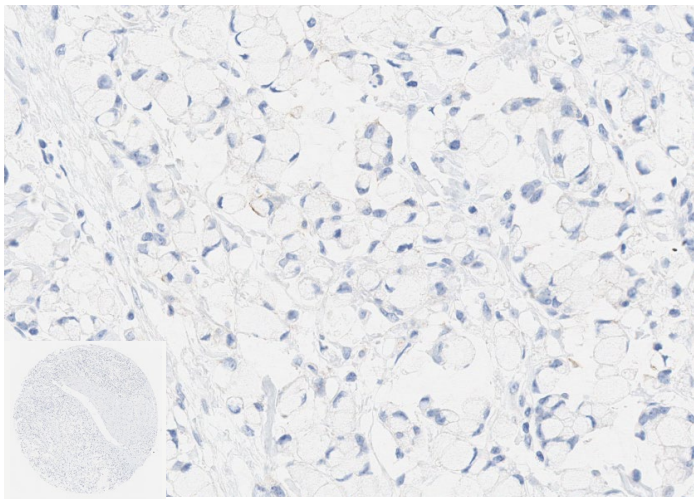
Undifferentiated carcinoma (0)



Signet ring cell carcinoma (2+)



Signet ring cell carcinoma (0)



Mucinous adenocarcinoma, Grade II (0)

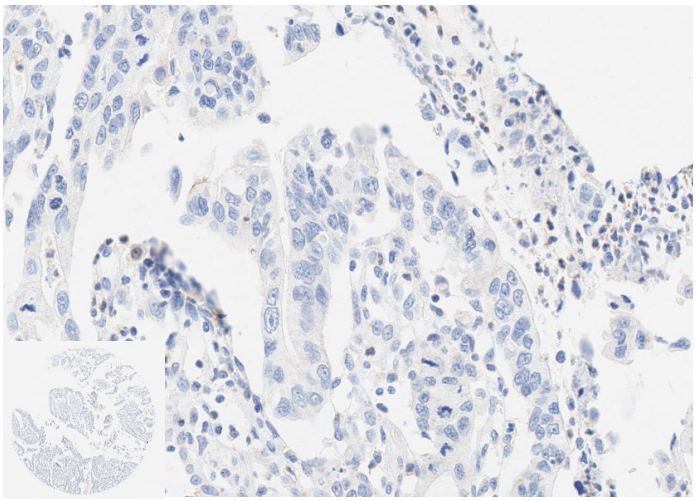


Figure 4. HER2 expression in stomach cancer. IHC images show HER2 staining in brown; nuclear hematoxylin counterstain in blue. IHC score in brackets. Slides were scanned at 20x (whole core insets at 5x) on Aperio® AT2 and imaged at 20x on Aperio® ImageScope.

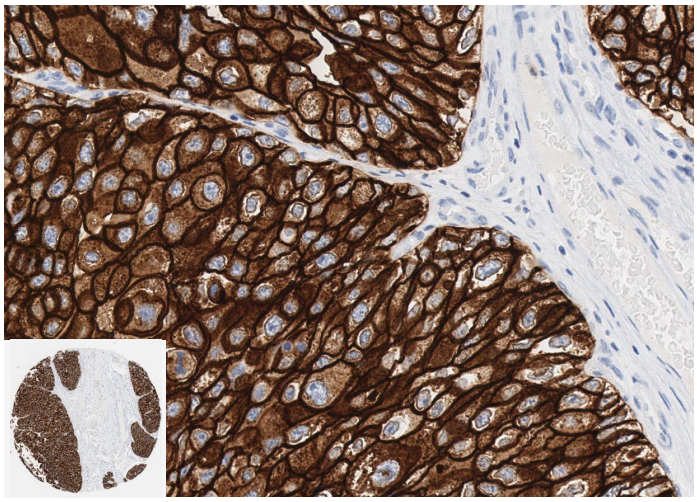
AB0335_v2.0_112924

HER2 expression in bladder cancer (DISCOVERY ULTRA)

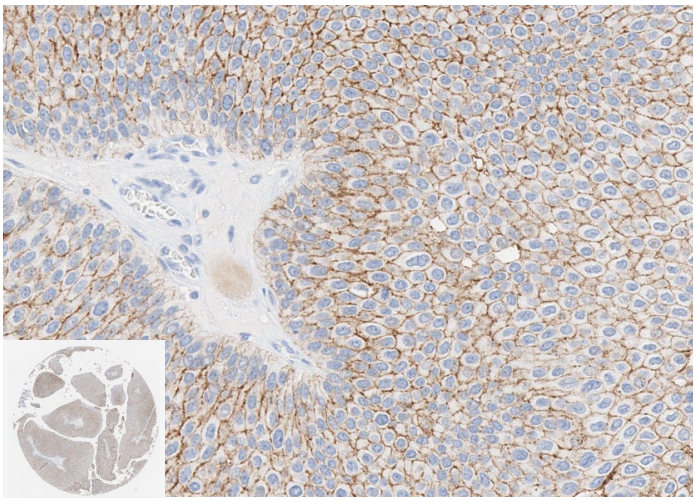
Below are the representative images of HER2 expression in individual cases of each analyzed bladder cancer subtype. Immunohistochemical staining patterns varied from no (0) expression to strong (3+) expression.

HER2

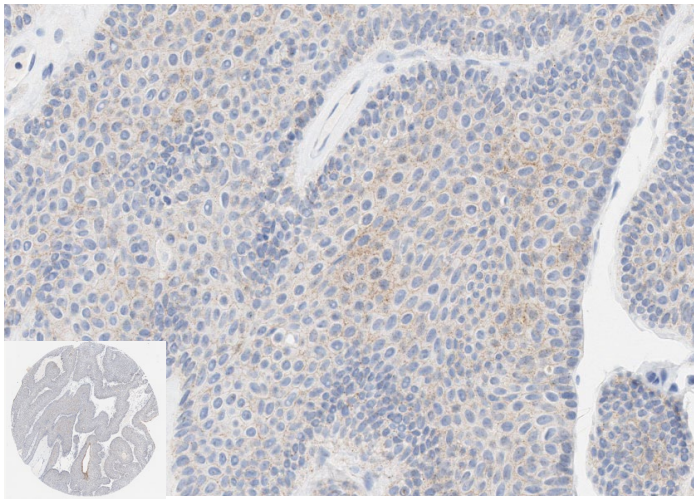
Transitional cell carcinoma, Grade III (3+)



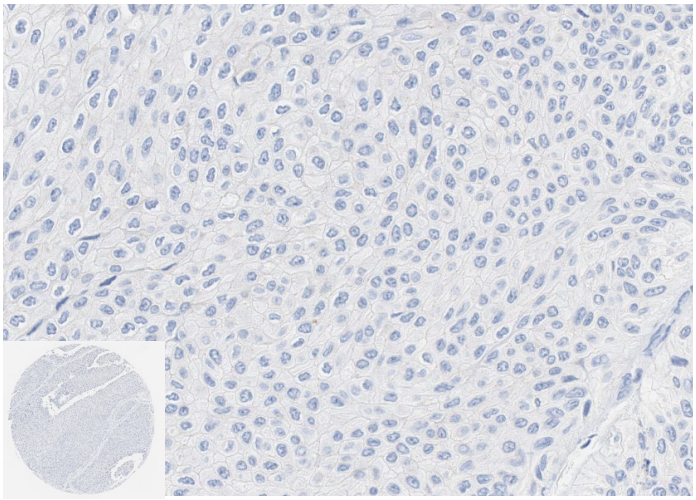
Transitional cell carcinoma, Grade II (2+)



Transitional cell carcinoma, Grade I (1+)

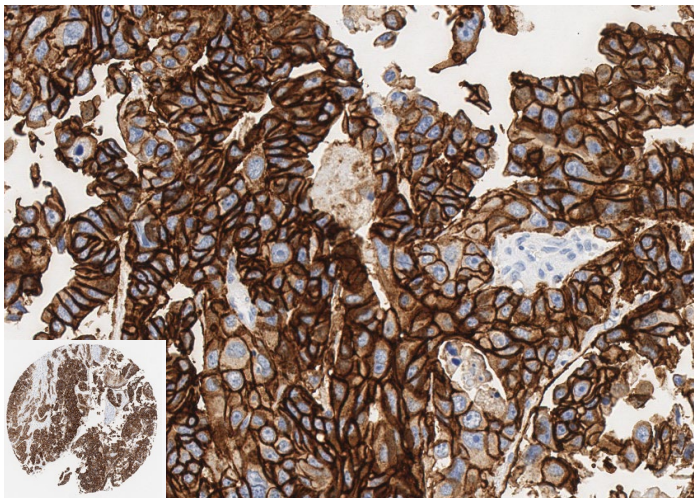


Transitional cell carcinoma, Grade I (0)

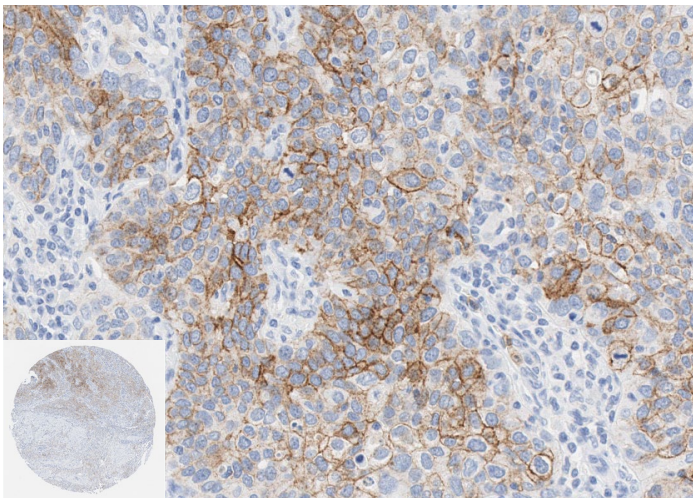


HER2

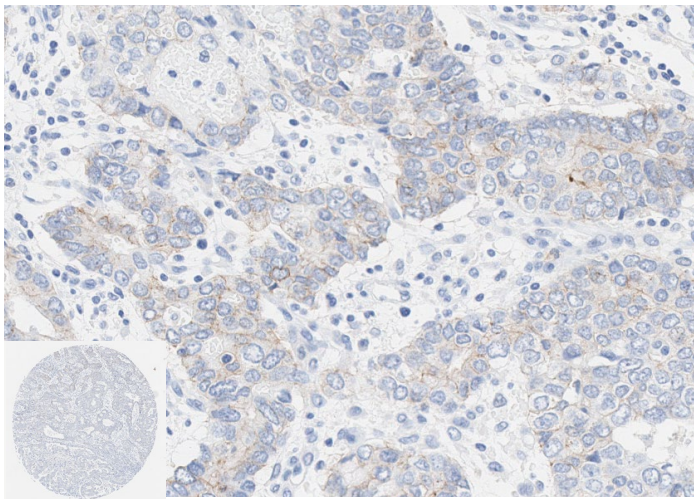
Adenocarcinoma, Grade III (3+)



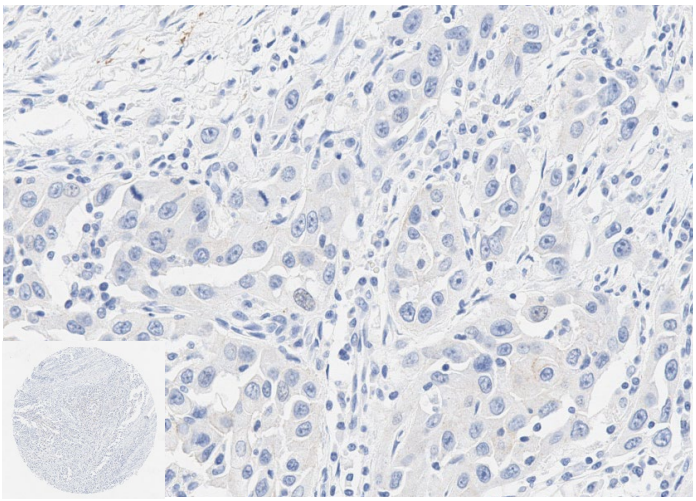
Adenocarcinoma, Grade III (2+)



Adenocarcinoma, Grade III (1+)

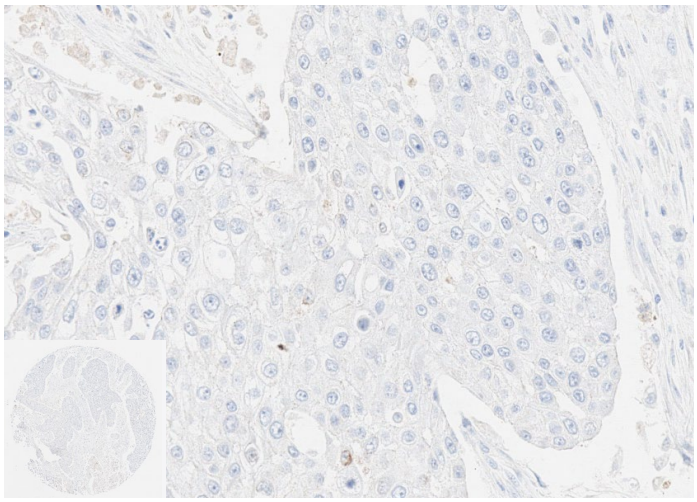


Adenocarcinoma, Grade III (0+)

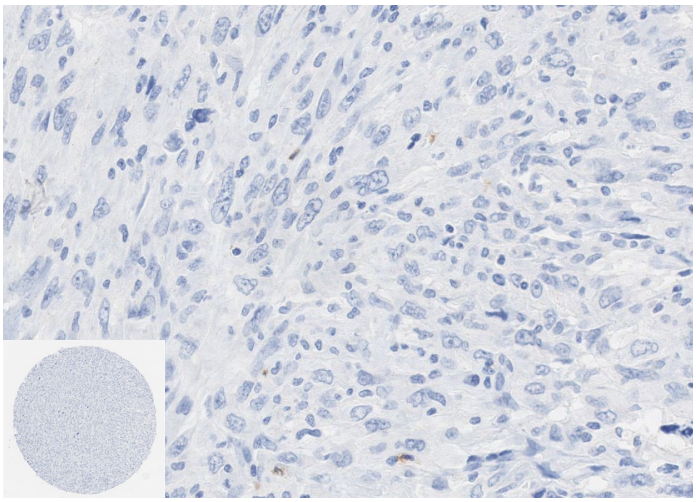


HER2

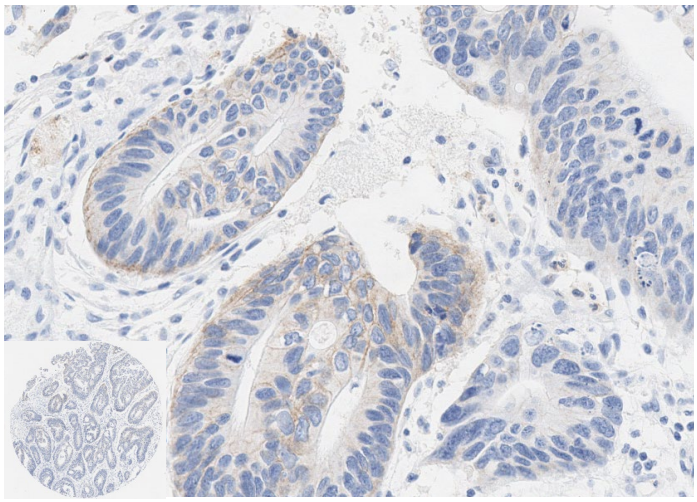
Squamous cell carcinoma, Grade II (0)



Carcinosarcoma (0)



Mucinous adenocarcinoma (1+)



Adenosquamous carcinoma (0)

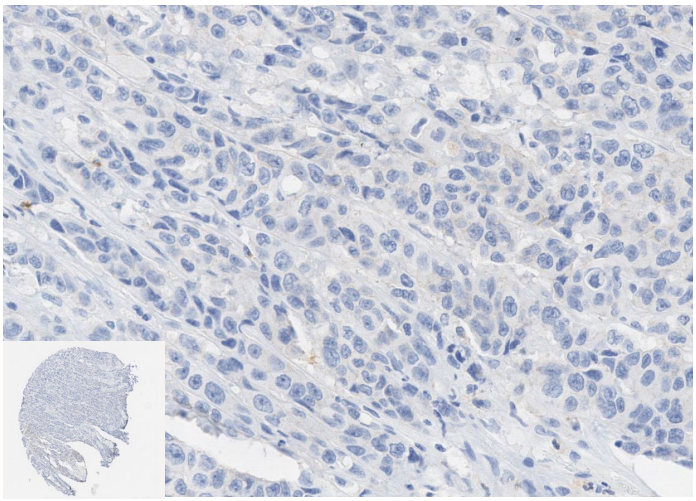


Figure 5. HER2 expression in bladder cancer. IHC images show HER2 staining in brown; nuclear hematoxylin counterstain in blue. IHC score in brackets. Slides were scanned at 20x (whole core insets at 5x) on Aperio® AT2 and imaged at 20x on Aperio® ImageScope.

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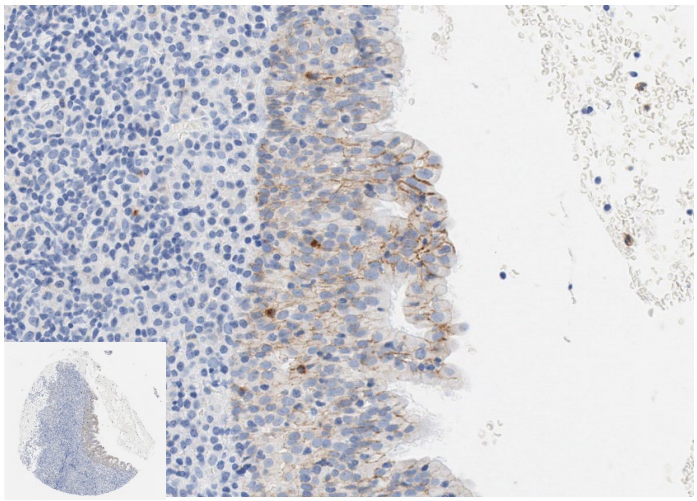
HER2 expression in nasopharyngeal cancer (DISCOVERY ULTRA)

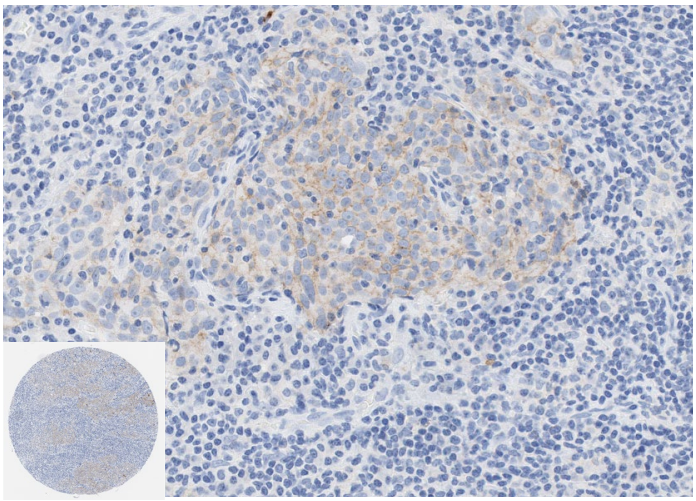
Below are the representative images of analyzed individual cases of nasopharyngeal cancer. Most cases showed no (0) HER2 expression, with the occasional case of weak (1+) to moderate (2+) staining.

HER2

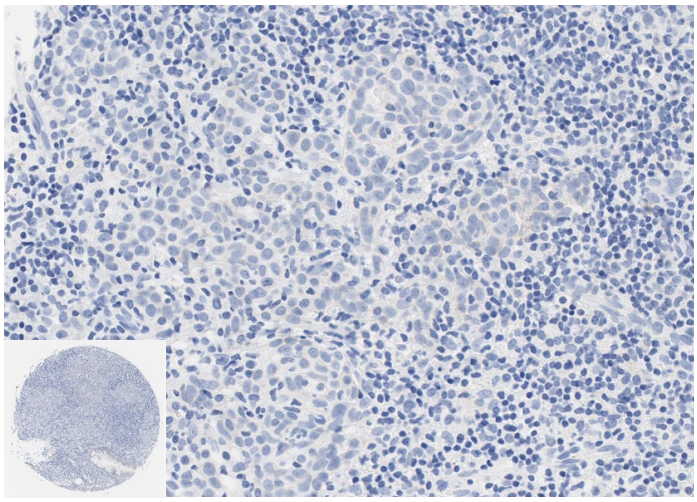
Non-keratinizing undifferentiated carcinoma, Grade III (2+)



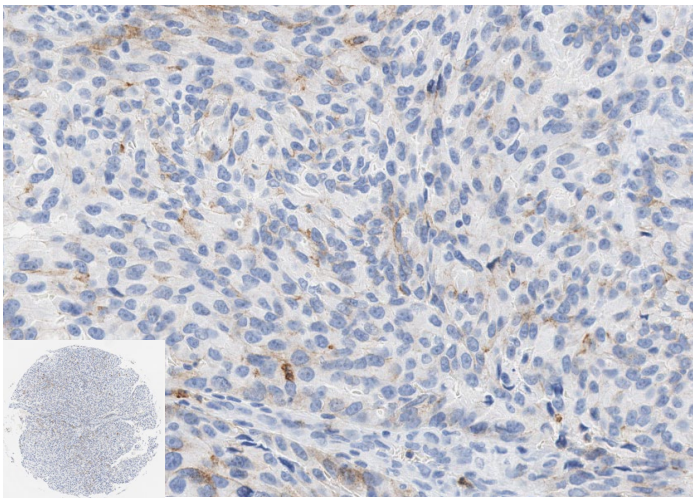
Non-keratinizing undifferentiated carcinoma, Grade III (1+)



Non-keratinizing undifferentiated carcinoma, Grade III (0)



Metastatic NPC, Grade III (1+)



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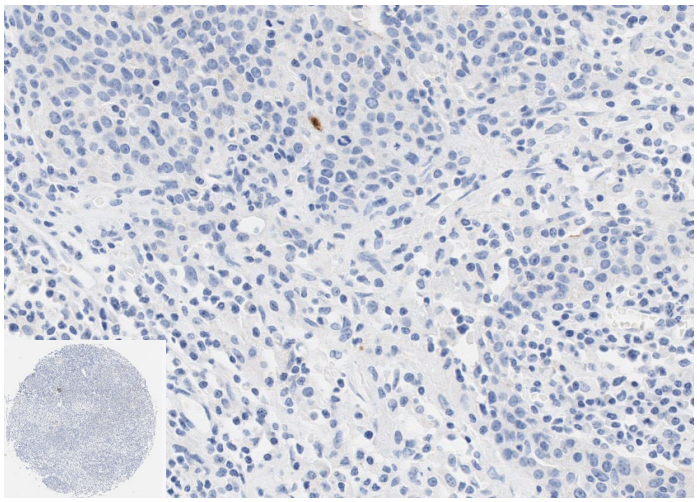
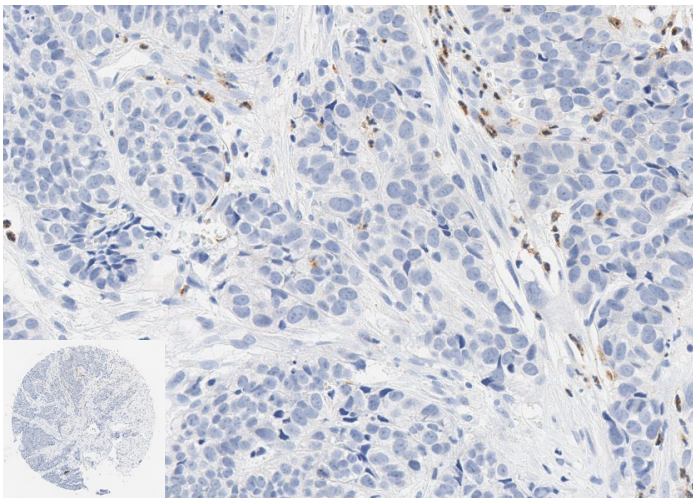
HER2

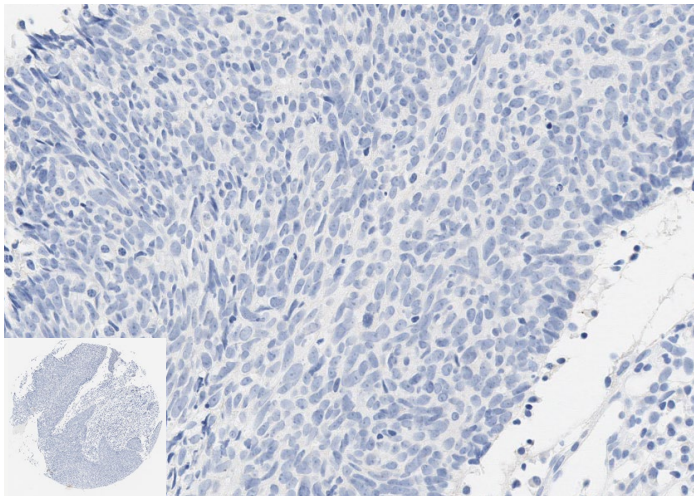
Metastatic NPC, Grade III (0)



Squamous cell carcinoma, Grade III (0)



Non-keratinizing differentiated carcinoma, Grade II (0)



Keratinizing differentiated carcinoma, Grade I (0)

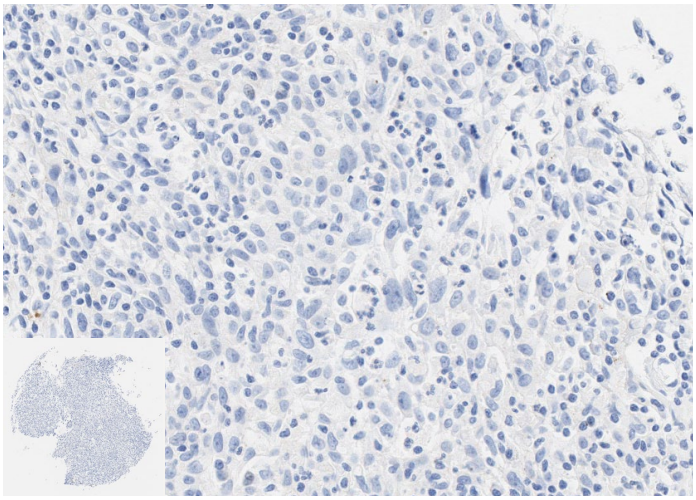


Figure 6. HER2 expression in nasopharyngeal cancer. IHC images show HER2 staining in brown; nuclear hematoxylin counterstain in blue. IHC score in brackets. Slides were scanned at 20x (whole core insets at 5x) on Aperio® AT2 and imaged at 20x on Aperio® ImageScope.

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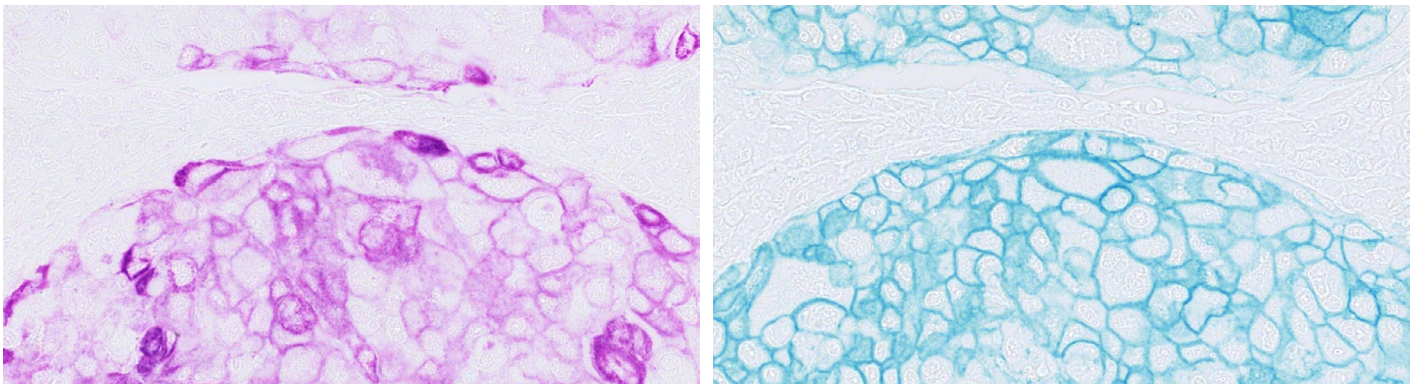
HER2 expression in cervical cancer (DISCOVERY ULTRA)

MUC4 is expected to colocalize with HER2 at the cell surface and in the cytoplasm, where it activates HER2 signaling[20,21]. Below are the representative images of MUC4 and HER2 in two individual cases of cervical cancer, imaged using a duplex chromogenic assay.

Cervical squamous cell carcinoma

MUC4 (a) HER2 (b)



MUC4 / HER2 / HER2 & MUC4 (c)

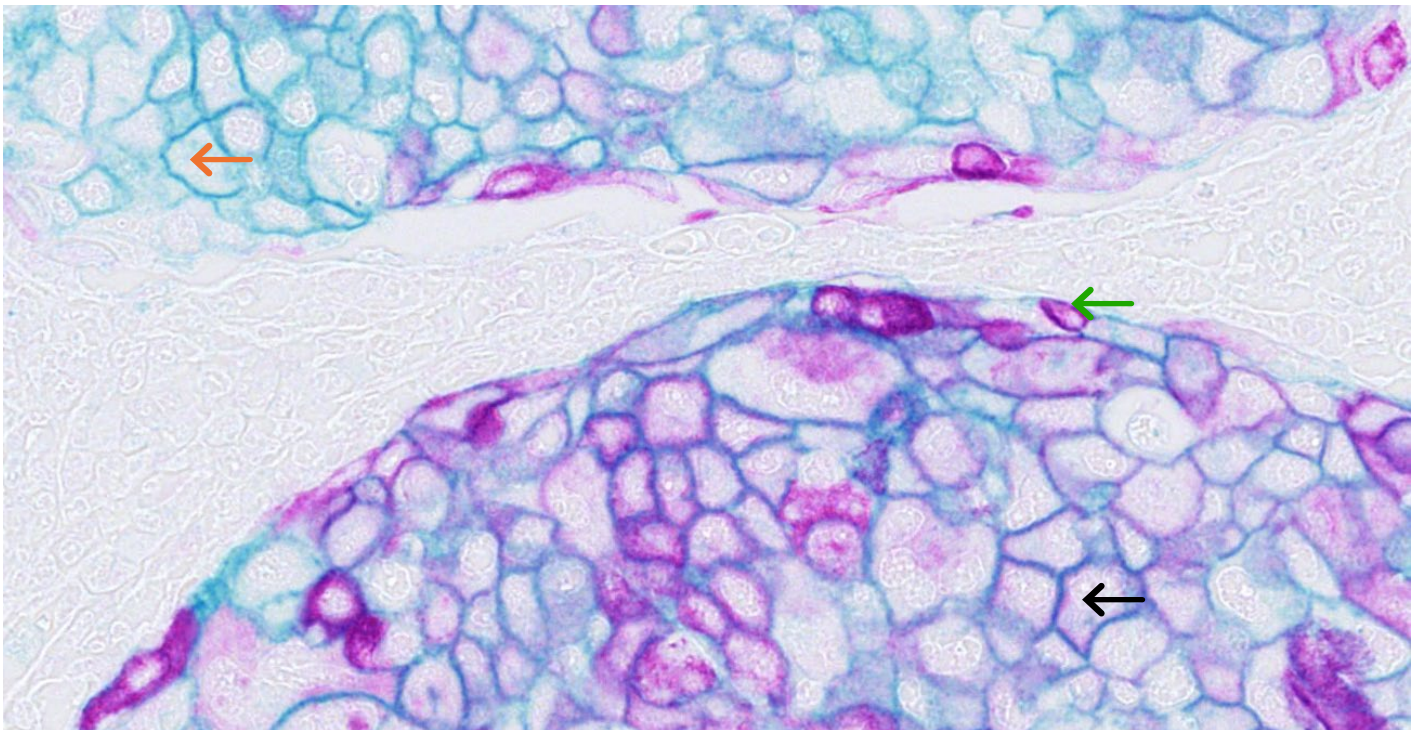


Figure 7. MUC4 and HER2 expression using a duplex co-localization assay. IHC staining of sequential sections of human cervical cancer tissue. The green, orange and black arrows represent MUC4+ (purple), HER2+ (teal) and MUC4+HER2+ (blue) cells. The below table describes the staining conditions used in the duplex assay.

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Enhanced validation data

Figure	1st Primary antibody (purple)	2nd Primary antibody (teal)
a	MUC4	IHC diluent
b	IHC diluent	HER2
c	MUC4	IHC diluent

Slides were scanned at 40x on NanoZoomer S360 (Hamamatsu Photonics K.K.) and imaged at 40X on Aperio® ImageScope.

NanoZoomer® is a registered trademark of Hamamatsu Photonics K.K.

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HER2 expression in human tissue (BOND RX)

Below are representative images of selected human cancer tissues stained on the BOND RX platform.

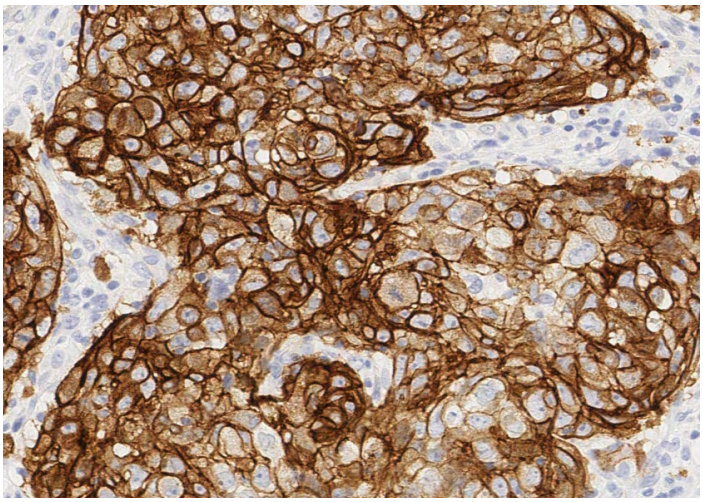
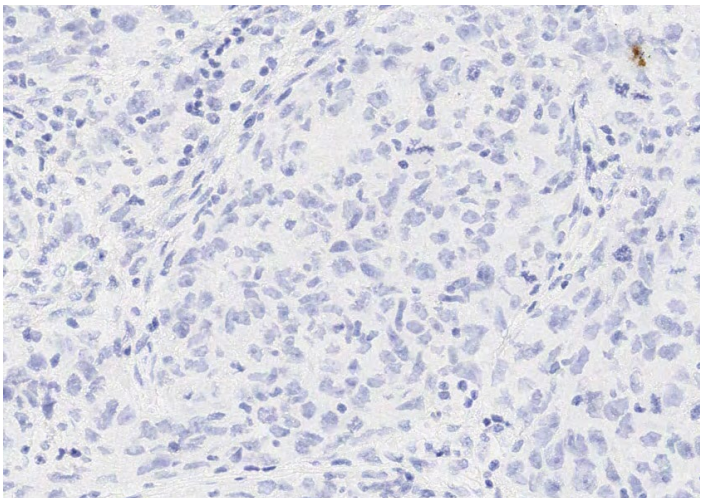
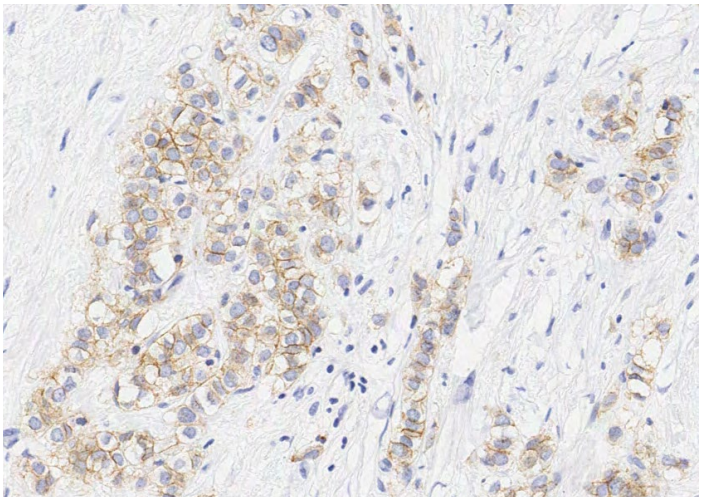
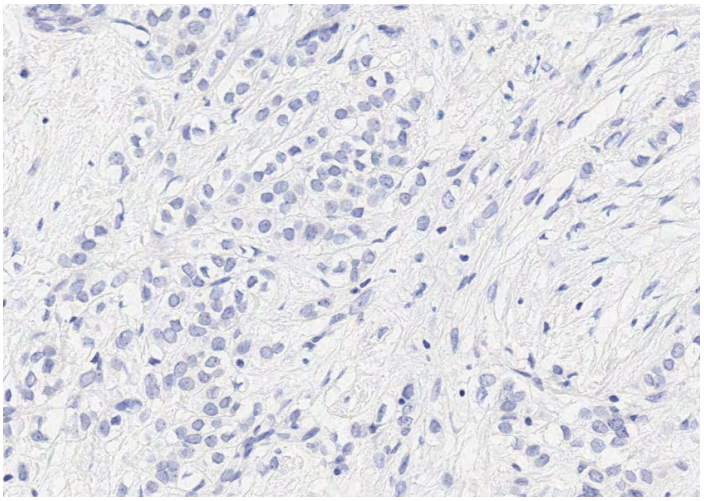
HER2	Isotype control
Breast carcinoma (3+)	
	
Breast carcinoma (2+)	
	

Figure 8. HER2 expression in human normal and cancer tissues. IHC images show HER2 staining in brown; nuclear hematoxylin counterstain in blue. IHC score in brackets. Slides were scanned at 20x (whole core insets at 5x) on Aperio® AT2 and imaged at 20x on Aperio® ImageScope.

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References

1. Iqbal N, Iqbal N. Human Epidermal Growth Factor Receptor 2 (HER2) in Cancers: Overexpression and Therapeutic Implications. *Mol Biol Int.* 2014;2014:852748. doi: 10.1155/2014/852748. Epub 2014 Sep 7. PMID: 25276427; PMCID: PMC4170925.

2. Ingthorsson S, Andersen K, Hilmarsdottir B, Maelandsmo GM, Magnusson MK, Gudjonsson T. HER2 induced EMT and tumorigenicity in breast epithelial progenitor cells is inhibited by coexpression of EGFR. *Oncogene.* 2016 Aug 11;35(32):4244-55. doi: 10.1038/onc.2015.489. Epub 2015 Dec 21. PMID: 26686087; PMCID: PMC4981873.

3. Dawood S, Broglio K, Buzdar AU, Hortobagyi GN, Giordano SH. Prognosis of women with metastatic breast cancer by HER2 status and trastuzumab treatment: an institutional-based review. *J Clin Oncol.* 2010 Jan 1;28(1):92-8. doi: 10.1200/JCO.2008.19.9844. Epub 2009 Nov 23. PMID: 19933921; PMCID: PMC2799236.

4. Early Breast Cancer Trialists' Collaborative group (EBCTCG). Trastuzumab for early-stage, HER2-positive breast cancer: a meta-analysis of 13 864 women in seven randomised trials. *Lancet Oncol.* 2021 Aug;22(8):1139-1150. doi: 10.1016/S1470-2045(21)00288-6. PMID: 34339645; PMCID: PMC8324484.

5. Burstein HJ. The distinctive nature of HER2-positive breast cancers. *N Engl J Med.* 2005 Oct 20;353(16):1652-4. doi: 10.1056/NEJMp058197. PMID: 16236735.

6. Yonemura Y, Ninomiya I, Yamaguchi A, Fushida S, Kimura H, Ohoyama S, Miyazaki I, Endou Y, Tanaka M, Sasaki T. Evaluation of immunoreactivity for erbB-2 protein as a marker of poor short term prognosis in gastric cancer. *Cancer Res.* 1991 Feb 1;51(3):1034-8. PMID: 1670998.

7. Berchuck A, Kamel A, Whitaker R, Kerns B, Olt G, Kinney R, Soper JT, Dodge R, Clarke-Pearson DL, Marks P, et al. Overexpression of HER-2/neu is associated with poor survival in advanced epithelial ovarian cancer. *Cancer Res.* 1990 Jul 1;50(13):4087-91. PMID: 1972347.

8. Santin AD, Bellone S, Van Stedum S, Bushen W, Palmieri M, Siegel ER, De Las Casas LE, Roman JJ, Burnett A, Pecorelli S. Amplification of c-erbB2 oncogene: a major prognostic indicator in uterine serous papillary carcinoma. *Cancer.* 2005 Oct 1;104(7):1391-7. doi: 10.1002/cncr.21308. PMID: 16116605.

9. Kavuri SM, Jain N, Galimi F, Cottino F, Leto SM, Migliardi G, Searleman AC, Shen W, Monsey J, Trusolino L, Jacobs SA, Bertotti A, Bose R. HER2 activating mutations are targets for colorectal cancer treatment. *Cancer Discov.* 2015 Aug;5(8):832-41. doi: 10.1158/2159-8290.CD-14-1211. PMID: 26243863; PMCID: PMC4527087.

10. Coogan CL, Estrada CR, Kapur S, Bloom KJ. HER-2/neu protein overexpression and gene amplification in human transitional cell carcinoma of the bladder. *Urology.* 2004 Apr;63(4):786-90. doi: 10.1016/j.urology.2003.10.040. PMID: 15072912.

11. Bunn PA Jr, Helfrich B, Soriano AF, Franklin WA, Varella-Garcia M, Hirsch FR, Baron A, Zeng C, Chan DC. Expression of Her-2/neu in human lung cancer cell lines by immunohistochemistry and fluorescence in situ hybridization and its relationship to in vitro cytotoxicity by trastuzumab and chemotherapeutic agents. *Clin Cancer Res.* 2001 Oct;7(10):3239-50. PMID: 11595720.

12. Pollock NI, Grandis JR. HER2 as a therapeutic target in head and neck squamous cell carcinoma. *Clin Cancer Res.* 2015 Feb 1;21(3):526-33. doi: 10.1158/1078-0432.CCR-14-1432. Epub 2014 Nov 25. PMID: 25424855; PMCID: PMC4315724.

13. Yoon HH, Shi Q, Sukov WR, Wiktor AE, Khan M, Sattler CA, Grothey A, Wu TT, Diasio RB, Jenkins RB, Sinicrope FA. Association of HER2/ErbB2 expression and gene amplification with pathologic features and prognosis in esophageal adenocarcinomas. *Clin Cancer Res.* 2012 Jan 15;18(2):546-54. doi: 10.1158/1078-0432.CCR-11-2272. PMID: 22252257; PMCID: PMC3261584.

AB0335_v2.0_112924

14. Cerami E, Gao J, Dogrusoz U, Gross BE, Sumer SO, Aksoy BA, Jacobsen A, Byrne CJ, Heuer ML, Larsson E, Antipin Y, Reva B, Goldberg AP, Sander C, Schultz N. The cBio cancer genomics portal: an open platform for exploring multidimensional cancer genomics data. *Cancer Discov.* 2012 May;2(5):401-4. doi: 10.1158/2159-8290.CD-12-0095. Erratum in: Cancer Discov. 2012 Oct;2(10):960. PMID: 22588877; PMCID: PMC3956037.

15. Gao J, Aksoy BA, Dogrusoz U, Dresdner G, Gross B, Sumer SO, Sun Y, Jacobsen A, Sinha R, Larsson E, Cerami E, Sander C, Schultz N. Integrative analysis of complex cancer genomics and clinical profiles using the cBioPortal. *Sci Signal.* 2013 Apr 2;6(269):pl1. doi: 10.1126/scisignal.2004088. PMID: 23550210; PMCID: PMC4160307.

16. de Bruijn I, Kundra R, Mastrogiacomo B, Tran TN, Sikina L, Mazor T, Li X, Ochoa A, Zhao G, Lai B, Abeshouse A, Baiceanu D, Ciftci E, Dogrusoz U, Dufilie A, Erkoc Z, Garcia Lara E, Fu Z, Gross B, Haynes C, Heath A, Higgins D, Jagannathan P, Kalletla K, Kumari P, Lindsay J, Lisman A, Leenknegt B, Lukasse P, Madela D, Madupuri R, van Nierop P, Plantalech O, Quach J, Resnick AC, Rodenburg SYA, Satravada BA, Schaeffer F, Sheridan R, Singh J, Sirohi R, Sumer SO, van Hagen S, Wang A, Wilson M, Zhang H, Zhu K, Rusk N, Brown S, Lavery JA, Panageas KS, Rudolph JE, LeNoue-Newton ML, Warner JL, Guo X, Hunter-Zinck H, Yu TV, Pilai S, Nichols C, Gardos SM, Philip J; AACR Project GENIE BPC Core Team, AACR Project GENIE Consortium; Kehl KL, Riely GJ, Schrag D, Lee J, Fiandalo MV, Sweeney SM, Pugh TJ, Sander C, Cerami E, Gao J, Schultz N. Analysis and Visualization of Longitudinal Genomic and Clinical Data from the AACR Project GENIE Biopharma Collaborative in cBioPortal. *Cancer Res.* 2023 Dec 1;83(23):3861-3867. doi: 10.1158/0008-5472.CAN-23-0816. PMID: 37668528; PMCID: PMC10690089.

17. Blum A, Wang P, Zenklusen JC. SnapShot: TCGA-Analyzed Tumors. *Cell.* 2018 Apr 5;173(2):530. doi: 10.1016/j.cell.2018.03.059. PMID: 29625059.

18. Schnitt SJ, Tarantino P, Collins LC. The American Society of Clinical Oncology-College of American Pathologists Guideline Update for Human Epidermal Growth Factor Receptor 2 Testing in Breast Cancer. Arch Pathol Lab Med. 2023 Sep 1;147(9):991-992. doi: 10.5858/arpa.2023-0187-ED. PMID: 37303241.

19. Wolff AC, Somerfield MR, Dowsett M, Hammond MEH, Hayes DF, McShane LM, Saphner TJ, Spears PA, Allison KH. Human Epidermal Growth Factor Receptor 2 Testing in Breast Cancer: ASCO-College of American Pathologists Guideline Update. *J Clin Oncol.* 2023 Aug 1;41(22):3867-3872. doi: 10.1200/JCO.22.02864. Epub 2023 Jun 7. PMID: 37284804.

20. Ponnusamy MP, Singh AP, Jain M, Chakraborty S, Moniaux N, Batra SK. MUC4 activates HER2 signalling and enhances the motility of human ovarian cancer cells. *Br J Cancer.* 2008 Aug 5;99(3):520-6. doi: 10.1038/sj.bjc.6604517. PMID: 18665193; PMCID: PMC2527793.

21. Chaturvedi P, Singh AP, Chakraborty S, Chauhan SC, Bafna S, Meza JL, Singh PK, Hollingsworth MA, Mehta PP, Batra SK. MUC4 mucin interacts with and stabilizes the HER2 oncoprotein in human pancreatic cancer cells. Cancer Res. 2008 Apr 1;68(7):2065-70. doi: 10.1158/0008-5472.CAN-07-6041. Erratum in: *Cancer Res.* 2008 May 1;68(9):3550. PMID: 18381409; PMCID: PMC2835497.

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