

Biomarker testing at a glance

Biomarker testing can enable more personalized medicine, help standardize treatment plans, and potentially improve prognosis.¹ However, knowing which biomarkers are relevant in each cancer—and how to test for them—may not always be clear.

Here you'll find a list of the **most common solid tumor types*** among men and women.² For each cancer, the actionable biomarkers and specific testing methodologies are shown per NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®).



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*According to "Cancer Facts & Figures 2026" by the American Cancer Society, inclusive of solid tumor types only.



Bladder cancer biomarkers³

Biomarkers

Testing option(s)

FGFR3 alterations



Molecular/genomic testing

HER2 overexpression



IHC

FGFR3=fibroblast growth factor receptor 3, HER2=human epidermal growth factor receptor 2, IHC=immunohistochemistry.



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Breast cancer biomarkers⁴

Biomarkers	Testing option(s)
Estrogen receptor (ER)	→ IHC
Progesterone receptor (PR)	→ IHC
HER2 (ERBB2) overexpression/amplification	→ IHC, ISH
Germline BRCA1/BRCA2	→ Germline sequencing
Germline PALB2	→ Germline sequencing
PIK3CA activating mutation	→ NGS, PCR
AKT1 activating mutation	→ NGS, PCR
PTEN inactivating mutation/genomic loss	→ NGS, PCR
ESR1 mutation	→ NGS, PCR
Microsatellite instability-high (MSI-H)/mismatch repair deficient (dMMR)	→ IHC, NGS, PCR
Tumor mutational burden-high (TMB-H)	→ NGS
NTRK1/2/3 gene fusion	→ FISH, NGS, PCR
RET gene fusion	→ NGS
21-gene assay (Oncotype DX) recurrence score	→ 21-gene RT-PCR assay
Breast Cancer Index (H/I)	→ Breast cancer index (BCI)

AKT1=AKT serine/threonine kinase 1, BRCA=breast cancer gene, ERBB2=erythroblastic oncogene B, ESR1=estrogen receptor, HER2=human epidermal growth factor receptor 2, FISH=fluorescence in situ hybridization, IHC=immunohistochemistry, ISH=in situ hybridization, NGS=next-generation sequencing, NTRK=neurotrophic receptor tyrosine kinase, PALB2=partner and localizer of BRCA2, PCR=polymerase chain reaction, PIK3CA=phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha, PTEN=phosphatase and tensin homologue, RET=rearranged during transfection, RT-PCR=reverse transcription-polymerase chain reaction.



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Colorectal cancer biomarkers⁵

Biomarkers

Testing option(s)

Microsatellite instability (MSI)	→	DNA analysis
Mismatch repair (MMR) (germline)	→	IHC
POLE and POLD1 (germline)	→	NGS, PCR, Sanger sequencing
KRAS/NRAS	→	MGPT
BRAF	→	IHC, MGPT
HER2 overexpression/amplifications	→	NGS, IHC, FISH
NTRK fusions	→	FISH, IHC, NGS

BRAF=B-Raf protein, DNA=deoxyribonucleic acid, FISH=fluorescence in situ hybridization, HER2=human epidermal growth factor receptor 2, IHC=immunohistochemistry, KRAS=Kirsten rat sarcoma virus oncogene homologue, MGPT=multigene panel testing, NGS=next-generation sequencing, NRAS=neuroblastoma RAS, NTRK=neurotrophic tropomyosin receptor kinase, PCR=polymerase chain reaction, POLD1=polymerase delta 1, POLE=polymerase epsilon.



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Kidney cancer biomarkers⁶

Hereditary renal cell carcinoma syndromes

Genes

Testing option(s)

Von Hippel-Lindau (**VHL**) gene



MGPT, clinically directed single-gene testing

Tuberous sclerosis complex (**TSC1/TSC2**)



Genetic counseling and testing per hereditary RCC evaluation algorithm

Hereditary leiomyomatosis and RCC (**FH**)



Genetic counseling and testing when histologic syndrome features or clinical criteria are met per the hereditary RCC evaluation algorithm

Hereditary papillary renal carcinoma (**MET**)



Genetic counseling and testing when histologic syndrome features or clinical criteria are met per the hereditary RCC evaluation algorithm

Birt-Hogg-Dubé syndrome (**FLCN**)



Genetic counseling and targeted testing, if criteria are met

BAP1 tumor predisposition syndrome (**BAP1**)



Genetic counseling and testing, if criteria are met

Hereditary paraganglioma/pheochromocytoma syndromes (**SDHA/SDHB/SDHC/SDHD**)



Genetic counseling and testing when histologic syndrome features or clinical criteria are met per the hereditary RCC evaluation algorithm

BAP1=BRCA1-associated protein 1, FH=familial hypercholesterolemia, FLCN=follculin, MET=mesenchymal epithelial transition, MGPT=multigene panel test; RCC=renal cell cancer, SDHA/B/C/D= succinate dehydrogenase A/B/C/D.



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Lung cancer biomarkers⁷

Biomarkers

Testing option(s)

Epidermal growth factor receptor (EGFR)	→	NGS, PCR
Anaplastic lymphoma kinase (ALK)	→	FISH, IHC, NGS, PCR
ROS proto-oncogene 1 (ROS1) gene fusions	→	FISH, IHC, NGS, PCR
B-Raf proto-oncogene (BRAF) point mutations	→	NGS, PCR
NRG1 gene fusions	→	NGS
KRAS proto-oncogene (KRAS) point mutations	→	NGS, PCR
Mesenchymal-epithelial transition (MET) exon 14 (METex14) skipping variants	→	NGS
Rearranged during transfection (RET) inactivating mutation/genomic loss	→	FISH, NGS, PCR
Erb-B2 receptor tyrosine kinase 2 (ERBB2)/ HER2 gene mutation	→	NGS
HER2 protein overexpression	→	IHC
Hepatocyte growth factor receptor (HGFR)/ MET protein overexpression	→	IHC
Neurotrophic tropomyosin receptor kinase (NTRK1/2/3) gene fusions	→	FISH, IHC, NGS, PCR
Programmed death ligand 1 (PD-L1)	→	IHC

FISH=fluorescence in situ hybridization, HER2=human epidermal growth factor receptor 2, IHC=immunohistochemistry, NRG1=neuregulin 1, NGS=next-generation sequencing, PCR=polymerase chain reaction.



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Melanoma biomarkers⁸

Biomarkers

Testing option(s)

<i>BRAF</i> mutation	→	IHC, MGPT, PCR
<i>KIT</i> mutation	→	NGS, PCR
<i>TMB</i> (tumor mutational burden)	→	NGS, whole-exome sequencing
<i>NTRK1/2/3</i> gene fusions	→	MGPT

BRAF=B-Raf protein, IHC=immunohistochemistry, KIT=KIT proto-oncogene receptor tyrosine kinase, MGPT=multigene panel test, NGS=next-generation sequencing, NTRK=neurotrophic tropomyosin receptor kinase, PCR=polymerase chain reaction.



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Oropharyngeal cancer biomarkers⁹

Biomarkers

Testing option(s)

PD-L1	→	MGPT, IHC
MSI	→	MGPT
MMR	→	MGPT
HER2	→	MGPT
FGFR	→	MGPT
TMB	→	MGPT
Androgen receptor (AR)	→	MGPT
<i>NTRK1/2/3</i>	→	MGPT
<i>BRAF</i>	→	MGPT
<i>RET</i>	→	MGPT
p16 (marker for HPV)	→	IHC
HPV	→	PCR, ISH
Epstein-Barr virus (EBV)	→	ISH, IHC, PCR

BRAF=B-Raf protein, FGFR=fibroblast growth factor receptor, HER2=human epidermal growth factor receptor 2, HPV=human papillomavirus, IHC=immunohistochemistry, ISH=in situ hybridization, MGPT=multigene panel test, MMR=mismatch repair, MSI=microsatellite instability, NTRK=neurotrophic tropomyosin receptor kinase, PCR=polymerase chain reaction, PD-L1=programmed death-ligand 1, RET=rearranged during transfection, TMB=tumor mutational burden.



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Pancreatic cancer biomarkers¹⁰

Biomarkers	Testing option(s)
<i>NRG1</i> fusion	→ NGS
<i>NTRK</i> fusion	→ NGS
<i>BRAF</i>	→ NGS
HER2 amplification	→ NGS
HER2 overexpression	→ FISH, IHC
MSI	→ NGS
dMMR	→ NGS
TMB	→ NGS
<i>ALK</i> fusion	→ NGS, PCR
<i>FGFR2</i> gene fusions	→ NGS
<i>BRCA1/BRCA2</i>	→ Comprehensive gene panels for hereditary cancer syndromes
<i>PALB2</i>	→ Comprehensive gene panels for hereditary cancer syndromes
<i>MLH1</i>	→ Comprehensive gene panels for hereditary cancer syndromes
<i>MSH2</i>	→ Comprehensive gene panels for hereditary cancer syndromes
<i>MSH6</i>	→ Comprehensive gene panels for hereditary cancer syndromes
<i>PMS2</i>	→ Comprehensive gene panels for hereditary cancer syndromes
<i>ATM</i>	→ Comprehensive gene panels for hereditary cancer syndromes
Cyclin-dependent kinase inhibitor 2A (<i>CDKN2A</i>)	→ Comprehensive gene panels for hereditary cancer syndromes

ALK=anaplastic lymphoma kinase, ATM=ataxia-telangiectasia mutated gene, BRAF=B-Raf protein, BRCA=breast cancer gene, dMMR=deficient mismatch repair, FGFR2=fibroblast growth factor receptor 2, FISH=fluorescence in situ hybridization, HER2=human epidermal growth factor receptor 2, IHC=immunohistochemistry, MLH1=MutL homologue 1, MSH2=MutS homologue 2, MSH6=MutS homologue 6, MSI=microsatellite instability, NRG1=neuregulin 1, NGS=next-generation sequencing, NTRK=neurotrophic receptor tyrosine kinase, PALB2=partner and localizer of BRCA2, PCR=polymerase chain reaction, PMS2=postmeiotic segregation increased 2, TMB=tumor mutational burden.



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Prostate cancer biomarkers¹¹

Biomarkers

Testing option(s)

Homologous recombination repair (HRR) gene alterations (eg, BRCA1 , BRCA2 , ATM , PALB2 , FANCA , RAD51D , CHEK2 , CDK12)	→	Multigene tumor testing
Microsatellite instability-high (MSI-H)/deficient mismatch repair (dMMR)	→	NGS
Tumor mutational burden (TMB)	→	TMB
Germline DNA repair gene mutations (eg, BRCA1 , BRCA2 , ATM , PALB2 , CHEK2 , MLH1 , MSH2 , MSH6 , PMS2)	→	Multigene tumor testing

ATM=ataxia-telangiectasia mutated, BRCA=breast cancer gene, CDK12=cyclin-dependent kinase 12, CHEK2=checkpoint kinase 2, FANCA=Fanconi anemia complementation group A, MLH1=mutL homologue 1, MSH=mutS homologue, NGS=next-generation sequencing, PALB2=partner and localizer of BRCA2, PMS2=postmeiotic segregation increased 2, RAD51D=RAD51 paralog D.



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Thyroid cancer biomarkers¹²

Biomarkers

Testing option(s)

BRAF V600E mutation



BRAF IHC

NTRK



Multiple assays or individual mutational analysis

ALK



Multiple assays or individual mutational analysis

Germline mutations of **RET** pathologic variants associated with **MEN2A** or **FMTC**:

- Codon M918T mutations
- Codon 634 and A883F mutations



Multiple assays or individual mutational analysis

MSI



Multiple assays or individual mutational analysis

dMMR



Multiple assays or individual mutational analysis

Tumor mutational burden (**TMB**)



Multiple assays or individual mutational analysis

ALK=anaplastic lymphoma kinase, BRAF=B-Raf protein; dMMR=deficient mismatch repair, FMTC=familial medullary thyroid carcinoma, IHC=immunohistochemistry, MEN2A=multiple endocrine neoplasia type 2A, MSI=microsatellite instability, NTRK=neurotrophic receptor tyrosine kinase, RET=rearranged during transfection.



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Uterine cancer biomarkers¹³

Biomarkers		Testing option(s)
MSI-H/dMMR	→	IHC, NGS, PCR
HER2	→	FISH, IHC
p53 aberrant	→	IHC

dMMR=deficient mismatch repair, FISH=fluorescence in situ hybridization, HER2=human epidermal growth factor receptor 2, IHC=immunohistochemistry, MSI-H=microsatellite instability-high, NGS=next-generation sequencing, PCR=polymerase chain reaction.



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