

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 (<i>VHL</i>) gene | → MGPT, clinically directed single-gene testing |
| Tuberous sclerosis complex (<i>TSC1/TSC2</i>) | → Genetic counseling and testing per hereditary RCC evaluation algorithm |
| Hereditary leiomyomatosis and RCC (<i>FH</i>) | → Genetic counseling and testing when histologic syndrome features or clinical criteria are met per the hereditary RCC evaluation algorithm |
| Hereditary papillary renal carcinoma (<i>MET</i>) | → Genetic counseling and testing when histologic syndrome features or clinical criteria are met per the hereditary RCC evaluation algorithm |
| Birt-Hogg-Dubé syndrome (<i>FLCN</i>) | → Genetic counseling and targeted testing, if criteria are met |
| BAP1 tumor predisposition syndrome (<i>BAP1</i>) | → Genetic counseling and testing, if criteria are met |
| Hereditary paraganglioma/pheochromocytoma syndromes (<i>SDHA/SDHB/SDHC/SDHD</i>) | → 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=follliculin, 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 (<i>EGFR</i>) | → | NGS, PCR |
| Anaplastic lymphoma kinase (<i>ALK</i>) | → | FISH, IHC, NGS, PCR |
| ROS proto-oncogene 1 (<i>ROS1</i>) gene fusions | → | FISH, IHC, NGS, PCR |
| B-Raf proto-oncogene (<i>BRAF</i>) point mutations | → | NGS, PCR |
| <i>NRG1</i> gene fusions | → | NGS |
| <i>KRAS</i> proto-oncogene (<i>KRAS</i>) point mutations | → | NGS, PCR |
| Mesenchymal-epithelial transition (<i>MET</i>) exon 14 (<i>METex14</i>) skipping variants | → | NGS |
| Rearranged during transfection (<i>RET</i>) inactivating mutation/genomic loss | → | FISH, NGS, PCR |
| Erb-B2 receptor tyrosine kinase 2 (<i>ERBB2</i>)/ <i>HER2</i> gene mutation | → | NGS |
| <i>HER2</i> protein overexpression | → | IHC |
| Hepatocyte growth factor receptor (<i>HGFR/MET</i>) protein overexpression | → | IHC |
| Neurotrophic tropomyosin receptor kinase (<i>NTRK1/2/3</i>) gene fusions | → | FISH, IHC, NGS, PCR |
| Programmed death ligand 1 (<i>PD-L1</i>) | → | IHC |

FISH=fluorescence in situ hybridization, HER2=human epidermal growth factor receptor 2, IHC=immunohistochemistry, NGR1=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, NGR1=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, <i>BRCA1</i> , <i>BRCA2</i> , <i>ATM</i> , <i>PALB2</i> , <i>FANCA</i> , <i>RAD51D</i> , <i>CHEK2</i> , <i>CDK12</i>) | → Multigene tumor testing |
| Microsatellite instability-high (MSI-H)/deficient mismatch repair (dMMR) | → NGS |
| Tumor mutational burden (TMB) | → TMB |
| Germline DNA repair gene mutations (eg, <i>BRCA1</i> , <i>BRCA2</i> , <i>ATM</i> , <i>PALB2</i> , <i>CHEK2</i> , <i>MLH1</i> , <i>MSH2</i> , <i>MSH6</i> , <i>PMS2</i>) | → 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 : <ul style="list-style-type: none"> • 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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