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# Next-Generation Sequencing (NGS) Biomarker & Fusion Testing: Targeted Therapy for Brain Tumors/Cancers

*A Patient & Caregiver Guide*

Your guide to understanding personalized medicine, why your tumor's genetic profile matters, and how to access NGS testing across the United States.

**This guide was developed to help patients and caregivers better understand:**

- What Next-Generation Sequencing (NGS) is
- How biomarker testing works
- The role of precision medicine in brain cancer care
- How to access testing and targeted therapy options

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# SECTION 1: What Is NGS and Why Does It Matter for Your Brain Tumor/Cancer?

## 1.1 Understanding Your Tumor's Genetic Blueprint

Every brain tumor is unique. Even two patients diagnosed with the same type of brain tumor, for example, glioblastoma (GBM) or diffuse midline glioma, can have very different tumors at the genetic level. These genetic differences affect how a tumor grows, how aggressive it is, and, most importantly, which treatments are most likely to work.

Next-Generation Sequencing (NGS) is a powerful laboratory technology that reads the genetic code of your tumor. It looks for specific changes called mutations, alterations, or biomarkers in the DNA or RNA of your cancer cells. These changes drive your tumor's growth. By identifying them, doctors can match you to treatments specifically designed to target those changes.

Think of it this way: imagine your tumor's DNA is like a very long instruction manual, thousands of pages long, that tells your tumor how to behave. NGS is like a highly sophisticated search engine that scans every page of that manual to find the specific sentences that are wrong or damaged. Once those "errors" are found, doctors can look for treatments designed to fix or block exactly those problems.

## 1.2 The Difference Between "Standard Treatment" and "Targeted Therapy"

Traditional cancer treatments like chemotherapy work by attacking rapidly dividing cells throughout your body both cancerous and healthy. They can be effective, but they often come with significant side effects because they are not specific to your tumor's unique biology.

Targeted therapy works differently. It is designed to attack cancer cells in a very specific way by blocking the particular genetic change or protein driving your tumor's growth. Because targeted therapies are more precise, they may cause fewer side effects and, for the right patient, can be more effective than standard treatment. NGS is what makes targeted therapy possible.

### Key Term: Biomarker Important Brain Tumor Markers NGS Can Detect

- IDH1 / IDH2 mutations (common in lower-grade gliomas and secondary GBM)
- H3 K27M mutation (defines diffuse midline glioma required for Modeyso eligibility)
- MGMT promoter methylation (predicts response to temozolomide chemotherapy)
- EGFR amplification / mutation (found in many GBMs; relevant to emerging targeted therapies)
- 1p/19q co-deletion (characteristic of oligodendroglioma)
- TERT promoter mutations
- BRAF mutations / fusions
- NTRK fusions (targetable with larotrectinib/entrectinib)
- MSI-H / TMB-H (may predict response to immunotherapy)
- CDKN2A homozygous deletion

### Pediatric-Specific Biomarkers (especially relevant for children and young adults)

- **H3 K27M mutation** defines diffuse midline glioma (DMG/DIPG); required for Modeyso eligibility
- **H3 G34R/V mutations** found in pediatric/young adult high-grade gliomas of the cerebral hemispheres
- **BRAF V600E mutation** common in pediatric low-grade gliomas (e.g., pleomorphic xanthoastrocytoma, ganglioglioma); targetable with BRAF/MEK inhibitors such as dabrafenib + trametinib
- **BRAF fusions (most commonly KIAA1549-BRAF)** hallmark of pediatric pilocytic astrocytoma; associated with favorable prognosis
- **NTRK fusions (NTRK1/2/3)** actionable in pediatric high- and low-grade gliomas; targetable with larotrectinib or entrectinib
- **MYC/MYCN amplification** aggressive driver in pediatric medulloblastoma and high-grade glioma; important prognostic marker
- **WNT/SHH pathway alterations** major molecular subgroups of medulloblastoma with distinct prognosis and treatment implications
- **NF1 mutations/deletions** associated with neurofibromatosis type 1 and optic pathway gliomas in children
- **ACVR1 mutations** found in a subset of DIPG/DMG tumors; currently being studied in clinical trials as a therapeutic target

## 1.3 What Happens During NGS Testing?

NGS testing is performed on a sample of your tumor tissue. In most cases, this tissue comes from a biopsy or surgery that has already been performed it does not necessarily require an additional procedure. There are three main ways tumor tissue can be preserved for NGS testing:

- **Formalin-Fixed Paraffin-Embedded (FFPE) tissue -** The most common method used in hospitals worldwide. Tumor tissue is treated with formalin (a preservative) and embedded in a wax block by the pathology laboratory. FFPE tissue blocks can be stored for years or even decades and remain compatible with most commercial NGS platforms. This is the standard format used by the vast majority of labs listed in Section 4.
- **Fresh (live) tumor tissue -** In some settings, especially at major academic centers or for research-based protocols, tumor tissue is collected fresh and processed immediately after surgery without fixation. Fresh tissue provides the highest quality nucleic acids (DNA and RNA) and enables the most comprehensive molecular analysis, including whole-genome and transcriptome sequencing. Some clinical trials specifically require fresh tissue collection. If you are having surgery at an academic center, ask whether fresh tissue banking is available.
- **Snap-frozen tissue (frozen in liquid nitrogen) -** Tumor tissue that is immediately flash-frozen in liquid nitrogen right after removal preserves the molecular integrity of both DNA and RNA far better than FFPE processing. Snap-frozen specimens are commonly banked in hospital or university biorepositories for research purposes and are preferred by many research laboratories and genomic studies. Some clinical trials and biobanking programs specifically request snap-frozen specimens. If your surgery is planned at a major academic or NCI-designated center, ask whether tumor tissue banking – including snap-freezing – is part of their standard care pathway.

In all three cases, the preserved tissue can often be used for NGS testing even years after it was originally collected. However, older FFPE blocks may have some DNA degradation that can affect test sensitivity.

Some newer NGS tests can also be performed using a blood sample. This is called a “liquid biopsy.” While liquid biopsies are less commonly used for brain tumors (because brain tumors shed less DNA into the bloodstream), they may be an option in certain situations.

Once your sample is sent to the lab, the testing process typically takes 2 to 3 weeks. The results come back as a detailed report that your neuro-oncologist will review with you.

## 1.4 How Is My Sample Collected? Your Testing Options

One of the most common questions we hear from patients is: *"Does NGS/Biomarker & Fusion Testing mean I need another surgery?"* The answer is often no and that comes as a real relief to many people.

NGS/Biomarker & Fusion Testing can be performed in several different ways depending on your situation, the type and location of your tumor, and what tissue or samples are already available. Below is a plain-language breakdown of each option.

**1. Tumor Tissue from a Previous Surgery (Most Common)**

For most brain tumor patients, NGS/Biomarker & Fusion Testing is done using tissue that was already removed during a past surgery. After surgery, the pathology lab preserves a small portion of your tumor in what's called a paraffin block (you may also hear this called FFPE tissue). This preserved tissue can often be stored for years and sent directly to a testing lab, no additional procedure needed.

This applies to patients who have had:

- A craniotomy (surgery to remove a tumor)
- A surgical tumor debulking
- An open biopsy

**2. Stereotactic Needle Biopsy**

If your tumor cannot be safely removed, your neurosurgeon may be able to obtain a small tissue sample using a procedure called a stereotactic needle biopsy. This is a minimally invasive procedure that uses advanced imaging to precisely target the tumor, even in hard-to-reach areas.

This approach is often used for tumors in the:

- Deep brain or thalamus
- Brainstem
- Areas near critical structures

Even a very small sample collected this way can often provide enough material for comprehensive genomic testing.

**3. Cerebrospinal Fluid (CSF) Testing “Spinal Tap"**

Your brain and spinal cord are surrounded by a fluid called cerebrospinal fluid, or CSF. In some cases, tumor DNA can be detected in this fluid, which is collected through a procedure called a lumbar puncture, more commonly known as a spinal tap.

A CSF liquid biopsy may be a good option when:

- Surgery is not possible or too risky
- Your tumor is in the brainstem or another difficult-to-reach location
- Your tumor has recurred and additional molecular information is needed

One important thing to know: because CSF is in direct contact with the brain and spinal cord, it often contains significantly more DNA tumor than a blood sample. This makes it a more sensitive option for brain tumor patients compared to blood-based testing.

*EBCI Partner Spotlight: Belay Diagnostics offers Summit™ 2.0, the only comprehensive NGS test performed specifically on CSF for CNS tumors. See Section 4 for more information.*

**4. Ventricular Reservoir or Shunt Fluid Collection**

Some patients have a medical device (such as an Ommaya reservoir, ventricular catheter, or shunt) that allows doctors to collect cerebrospinal fluid without performing a lumbar puncture. In certain situations, this fluid can be used for molecular and liquid biopsy testing, making it a convenient option for patients who already have one of these devices in place.

**5. Blood-Based Liquid Biopsy**

Some labs offer NGS/Biomarker & Fusion Testing using just a simple blood draw. This is called a liquid biopsy, and it has become a common testing method for many cancer types.

However, for primary brain tumors specifically, blood-based liquid biopsies are generally less sensitive. This is because the blood-brain barrier (a protective layer that separates the brain from the bloodstream) limits how much tumor DNA actually makes it into the blood.

That said, a blood-based liquid biopsy can still be useful:

- When no tissue sample is available
- For monitoring your disease over time
- To help detect recurrence in certain situations
- As an additional layer of testing alongside tissue testing

*Ask your care team whether blood-based testing makes sense for your specific situation.*

**6. Repeat Biopsy at Recurrence**

Tumors can change and evolve over time especially after treatment with radiation, chemotherapy, or targeted therapy. If your tumor has come back or is progressing, your doctor may recommend obtaining a new biopsy sample.

A repeat biopsy can uncover:

- New mutations that weren't present before
- New gene fusions
- Changes that explain why a previous treatment stopped working
- New opportunities for targeted therapy

This is an important option to discuss with your care team if your tumor has recurred, as the molecular profile of a recurrent tumor may be quite different from the original. You may not need another surgery to get tested.

## 1.5 Why NGS Is Especially Important for Brain Tumor Patients

Brain tumors, particularly high-grade gliomas like glioblastoma (GBM) and diffuse midline glioma (DMG), are among the most challenging cancers to treat. NGS offers a path forward by:

- Providing a more precise and complete diagnosis, the 2021 WHO Classification of Brain Tumors now requires molecular testing, including key NGS markers, for an accurate diagnosis.1
- Identifying mutations that may qualify you for FDA-approved targeted therapies, or for **off-label treatments**, meaning FDA-approved drugs that are being prescribed to treat a cancer type or genetic alteration for which they are not specifically approved by the FDA. Off-label use is legal and common in oncology. For example, a targeted therapy approved for a lung cancer mutation may also be used off-label for a brain tumor/cancer that carries the same genetic change. NGS results can reveal these cross-cancer treatment opportunities that would otherwise be missed. Your oncologist must assess potential benefits and risks, and insurance coverage for off-label use can vary and may require prior authorization.
- Matching you to clinical trials based on the specific genetic profile of your tumor.
- Helping your care team better predict how your tumor may behave and plan your treatment plan accordingly.

Research has shown that in patients with advanced cancers, nearly 2 in 5 have a genetic alteration that points to a targeted therapy or clinical trial option, but this can only be found through NGS testing.

1 Louis DN, Perry A, Wesseling P, et al. “The 2021 WHO Classification of Tumors of the Central Nervous System: a summary.” Neuro-Oncology. 2021;23(8):1231–1251. This classification requires integrated molecular diagnostics, including IDH mutation status, MGMT promoter methylation, 1p/19q codeletion, H3 K27M alteration, and other NGS-detectable markers, as part of the definitive diagnosis for most brain tumors.

## 1.6 NGS vs. Comprehensive Genomic Profiling: What’s the Difference?

You may hear your medical team use the terms “NGS,” “comprehensive genomic profiling,” “molecular profiling,” or “genomic testing” interchangeably. While they are closely related, they are not exactly the same thing, and understanding the distinction can help you ask better questions and ensure you are getting the most complete picture of your tumor.

**The Simple Distinction: NGS is the technology. Comprehensive Genomic Profiling (CGP) is the test your doctor orders.**

Think of it this way: NGS is the engine, and Comprehensive Genomic Profiling (CGP) is the car. NGS is the laboratory method (the high-speed machine that reads DNA). CGP is a specific type of clinical test that uses NGS technology to simultaneously analyze a large number of cancer-relevant genes **(typically 300 to 650+)**, looking for every major class of genetic change, mutations, deletions, fusions, copy number changes, TMB (Tumor Mutational Burden), and MSI (Microsatellite Instability) in a single report.

Not all NGS tests are comprehensive. A doctor could order a narrow NGS panel that only looks at 5 or 10 specific genes, that is still NGS technology, but it is not CGP. For brain tumor/cancer patients, broad CGP panels are strongly preferred because brain tumors can carry many different types of mutations, and a narrow test may miss an actionable finding that a broader panel would catch.

## How many biomarkers do a full NGS (CGP) panel test?

Depending on the platform, a comprehensive genomic profiling panel typically analyzes between 300 and 650+ cancer-relevant genes in a single test run. For example, FoundationOne CDx analyzes 324 genes; Tempus xT CDx covers 648 genes; Caris MI Profile examines 650+ genes; Mayo Clinic's MayoComplete panel covers 518 genes; and MSK-IMPACT tests 505 genes. Across these panels, the tests simultaneously detect four major classes of genetic alterations: (1) point mutations and small insertions/deletions (SNVs and indels), (2) copy number changes (amplifications and deletions), (3) gene fusions and rearrangements, and (4) genomic signatures such as tumor mutational burden (TMB) and microsatellite instability (MSI). Some panels also include RNA sequencing to capture fusion events that DNA testing alone may miss. In total, a full CGP panel can evaluate hundreds to thousands of individual biomarker data points in a single report far more than any targeted single-gene test could capture. This comprehensive view is why broad CGP is the preferred approach for brain tumor/cancer patients, where the full molecular landscape of the tumor must be understood to identify all possible treatment options and clinical trial opportunities.

The tests listed in Section 4 of this guide, such as FoundationOne CDx, Tempus xT CDx, Caris MI Profile, and Belay Summit™ 2.0, are all examples of CGP tests. They use NGS technology to deliver a wide, all-in-one tumor profile in a single report.

## 1.7 Gene Fusions: An Important Piece of the Puzzle

**What Is a Gene Fusion?**

Think of your DNA as a very long instruction manual. Sometimes, two separate sections of that manual are accidentally joined, creating a brand-new instruction that was never supposed to exist. This is called a gene fusion. In brain tumors, gene fusions can act as powerful drivers of tumor growth by creating abnormal proteins that tell cancer cells to continue growing and dividing. While gene fusions are less common than some other genetic alterations, they can be extremely important because they may reveal treatment opportunities that would otherwise remain hidden.

**Why Do Gene Fusions Matter?**

Researchers are increasingly recognizing gene fusions as important biomarkers in several brain tumor types. Some of the most clinically relevant include:

- **FGFR fusions:** found in certain gliomas, particularly lower-grade gliomas and some pediatric brain tumors.
- **NTRK fusions:** uncommon but highly significant because FDA-approved targeted therapies are available for patients whose tumors contain an NTRK fusion, regardless of where the cancer originated.
- **EGFR, MET, ALK, and ROS1 fusions:** less common in brain tumors but potentially targetable through approved therapies or clinical trials.

Identifying a gene fusion may open the door to a targeted therapy or clinical trial that would not otherwise be considered. This is one of the reasons comprehensive molecular testing is so important.

**Most NGS Tests Do Not Automatically Check for Fusions.**

This is something many patients and caregivers do not realize. Many standard NGS panels are primarily designed to identify mutations, deletions, and copy number changes in DNA. Gene fusions are a different type of alteration and often require additional testing methods to detect them accurately. In many cases, identifying a fusion requires:

- RNA sequencing (RNA-seq)
- A dedicated fusion detection assay
- A comprehensive genomic profiling (CGP) platform that includes fusion analysis

This means that a report stating “No actionable alterations found” may not tell the whole story. If fusion testing were not included, a potentially important treatment opportunity could have been missed.

**Questions to Ask Your Care Team**

- Did my NGS test include RNA sequencing or fusion detection?
- Given my tumor type, would additional fusion testing be appropriate?
- Were any potentially targetable fusions evaluated as part of my testing?
- Are there any clinical trials targeting gene fusions that I may qualify for?

Understanding whether fusion testing was performed can help ensure that you and your care team have the most complete picture of your tumor’s molecular profile and all available treatment options.

### Key Takeaway

**I**f your doctor has only ordered a small, single-gene test, for example, just testing for the IDH1 mutation alone, it is worth asking whether a full CGP panel has been or should be ordered as well. EBCI’s Patient Navigators can help you have that conversation. Contact us at EndBrainCancer.org.

# SECTION 2: A Real-World Example
# Modeyso (Dordaviprone) & the H3 K27M Mutation

## 2.1 What Is Diffuse Midline Glioma?

Diffuse midline glioma (DMG) is a rare, aggressive, and typically fatal type of brain tumor. It grows in the midline structures of the central nervous system, such as the brainstem, thalamus, and spinal cord, and spreads diffusely through surrounding brain tissue, making surgical removal nearly impossible. DMG primarily affects children and young adults, though it can occur at any age. It accounts for approximately 2,000 diagnoses per year in the United States.

## 2.2 The H3 K27M Mutation

In 2012, researchers discovered that a specific genetic mutation called the H3 K27M mutation was present in the majority of diffuse midline gliomas and drove the tumor's aggressive behavior. This mutation affects a protein called histone H3, which plays a role in controlling how genes are switched on or off in cells. The H3 K27M mutation is now a defining feature of DMG in the WHO classification of brain tumors.

Critically, a patient's tumor must be tested for the H3 K27M mutation to receive a correct diagnosis and, as of 2025, to be considered for the only current FDA-approved targeted treatment for this disease.

### Why NGS Was Essential Here

The H3 K27M mutation cannot be identified through standard imaging alone, or through older single-gene testing methods. It requires molecular testing, either via a targeted NGS panel or specific immunohistochemistry (IHC) staining. Without this testing, patients with H3 K27M-mutant DMG would not receive the correct diagnosis and would not be eligible for Modeyso (dordaviprone) (the only current FDA-approved treatment for this disease).

## 2.3 Modeyso (Dordaviprone): The First FDA-Approved Targeted Therapy for DMG

On August 6, 2025, the FDA granted accelerated approval to dordaviprone, sold under the brand name Modeyso, for the treatment of patients aged 1 year and older with recurrent H3 K27M-mutant diffuse midline glioma. This made Modeyso the first and only FDA-approved treatment specifically for this diagnosis. Modeyso (originally known as ONC201) was developed by Oncoceutics, acquired by Chimerix, and then acquired by Jazz Pharmaceuticals as part of a $935 million transaction completed in April 2025.

## Clinical Data Summary

| Measure | Result |
|---|---|
| Patients studied | 50 adults and pediatric patients across 5 open-label clinical trials |
| Overall Response Rate (ORR) | 22% (11 of 50 patients had measurable tumor shrinkage) |
| Duration of Response | Median 10.3 months; 73% maintained response ≥ 6 months; 27% ≥ 12 months |
| FDA Approval Type | Accelerated approval; confirmatory Phase 3 trial (ACTION) ongoing |
| NCCN Guidelines | Category 2A single-agent recommendation for recurrent/progressive H3 K27M-mutant diffuse high-grade glioma in both Pediatric CNS and Adult CNS guidelines (September 2025) |
| Dosing | 625 mg orally once weekly (adults and pediatric patients ≥52.5 kg); weight-based for smaller pediatric patients (125–500 mg weekly); taken on empty stomach |
| Eligible Age | 1 year and older |

## Who Is Eligible for Modeyso?

To receive Modeyso, a patient must:

- Have a confirmed diagnosis of diffuse midline glioma (DMG)
- Have confirmed presence of the H3 K27M mutation on tumor testing
- Have progressive or recurrent disease following prior therapy (typically radiation)

### A Note to Caregivers of Pediatric Patients

If your child has been diagnosed with a brain tumor in the brainstem, thalamus, or spinal cord, especially a diagnosis previously called DIPG (Diffuse Intrinsic Pontine Glioma), please ask your child's oncologist specifically whether molecular testing for H3 K27M has been performed. This single test could determine whether your child is eligible for Modeyso. Contact EBCI at EndBrainCancer.org for navigation support.

# SECTION 2B: A Real-World Example
# Voranigo (Vorasidenib) & the IDH1/IDH2 Mutation

## 2B.1 What Are IDH1 and IDH2?

IDH1 and IDH2 are genes that give cells instructions for making an enzyme your body uses for normal energy production. In certain brain tumors, a mutation (change) in one of these genes causes the enzyme to work abnormally, producing a build-up of a substance that blocks cells from maturing properly. When cells cannot mature the way, they should, they can begin to grow out of control, driving tumor formation.

IDH1 and IDH2 mutations are most commonly found in lower-grade gliomas (Grade 2 astrocytoma and oligodendroglioma), and in a smaller number of secondary glioblastomas (GBM that developed from a lower-grade tumor). These mutations are generally associated with a better prognosis than IDH-wildtype (non-mutated) tumors, though patients with IDH-mutant tumors still face real challenges and, until recently, had limited treatment options beyond surgery, radiation, and chemotherapy.

## 2B.2 Why NGS Was Essential Here

IDH1/IDH2 mutation status cannot be determined through imaging alone. It requires molecular testing either a targeted NGS panel or immunohistochemistry (IHC) staining for the most common mutation subtype (IDH1 R132H). Confirming IDH1/IDH2 status is now required under the 2021 WHO Classification of Brain Tumors for an accurate diagnosis of astrocytoma and oligodendroglioma, and it is the mutation that determines eligibility for the only current FDA-approved targeted therapy for this disease.

## 2B.3 Voranigo (Vorasidenib): The First FDA-Approved Targeted Therapy for Grade 2 IDH-Mutant Glioma

On August 6, 2024, the FDA approved vorasidenib, sold under the brand name Voranigo, for adult and pediatric patients 12 years and older with Grade 2 astrocytoma or oligodendroglioma carrying a susceptible IDH1 or IDH2 mutation, to be taken after surgery (biopsy, sub-total resection, or gross total resection). This made Voranigo the first and only FDA-approved systemic (whole-body) targeted therapy for this diagnosis, the first new treatment breakthrough in this specific disease area in nearly 25 years. Voranigo is developed by Servier Pharmaceuticals.

## Clinical Data Summary

| Measure | Result |
|---|---|
| Study design | Phase 3 INDIGO trial; randomized, double-blind, placebo-controlled |
| Patients studied | 331 patients with residual or recurrent Grade 2 IDH-mutant glioma following surgery |
| Primary benefit | Significant improvement in progression-free survival (time without tumor growth) compared to placebo |
| Additional benefit | Significantly longer time to next anticancer treatment (such as radiation or chemotherapy) |
| Dosing | Once-daily oral pill |
| Eligible age | 12 years and older |

## Who Is Eligible for Voranigo?

To be considered for Voranigo, a patient generally must:

- Have a confirmed diagnosis of Grade 2 astrocytoma or oligodendroglioma
- Have a confirmed susceptible IDH1 or IDH2 mutation on tumor testing
- Have already had surgery (biopsy, partial removal, or full removal)

### A Note on Higher-Grade IDH-Mutant Tumors

Voranigo's FDA approval is specifically for Grade 2 tumors. If you or your loved one has a higher-grade (Grade 3 or 4) IDH-mutant tumor, IDH-targeted treatment may still be relevant through a clinical trial or off-label discussion with your oncologist, ask your care team whether IDH-targeted options apply to your specific situation, since research in this area continues to evolve.

### Questions to Ask Your Care Team About IDH1/IDH2

- Has my tumor tissue been tested for IDH1 and IDH2 mutations?
- If I have an IDH mutation, am I eligible for Voranigo (vorasidenib)?
- What side effects should I watch for while taking Voranigo?
- Are there clinical trials studying IDH-targeted therapies for my specific tumor grade?

EBCI's Patient Navigator can help you have this conversation. Contact us at EndBrainCancer.org.

# SECTION 3: How NGS Opens Doors to More Treatment Options

## 3.1 From Diagnosis to Treatment: How NGS Fits Into Your Care

| Step | What Happens | Why It Matters |
|---|---|---|
| 1 | **Biopsy or surgery:** tumor sample is collected | Provides the tissue needed for molecular testing |
| 2 | **Pathology review:** standard microscopic analysis | Provides initial diagnosis, tumor type, grade |
| 3 | **NGS / molecular profiling:** tumor DNA/RNA is sequenced | Identifies mutations, biomarkers, and potential targets |
| 4 | **Results reviewed by your care team:** often at a tumor board | Your oncologist determines whether findings affect treatment options |
| 5 | **Treatment plan updated:** based on results | May include targeted therapy, clinical trial matching, or confirmation of current plan |

## 3.2 NGS and Brain Tumor Clinical Trials

One of the most powerful benefits of NGS testing is that it can match you to clinical trials you might not otherwise have known about. Many of today's brain tumor clinical trials require specific biomarkers or mutations as eligibility criteria. If you have not had NGS testing, you may unknowingly be excluded from trials for which you would otherwise qualify.

National programs like ComboMATCH, a next-generation precision medicine trial program led exclusively by the National Cancer Institute (NCI) and available only at NCI-designated cancer centers and NCI Community Oncology Research Program (NCORP) sites, use NGS to match patients to experimental drug combinations based on the specific mutations found in their tumor. The ComboMATCH Patient Registration Trial is identified as NCT05564377 (protocol EAY191); patients must first enroll in this screening trial through their oncologist at a participating NCI site before being assigned to a specific treatment trial. Note that ComboMATCH participation is limited to NCI-affiliated institutions and is not available through private oncology practices or non-NCI centers. Many pharmaceutical-sponsored trials, including those from companies like Black Diamond Therapeutics, Curis, and Nuvation Bio, include NGS-based screening as part of enrollment and are available at a broader range of sites.

At the End Brain Cancer Initiative, our Patient Navigators can help you understand your NGS results and identify clinical trials relevant to your specific tumor profile. Contact us at EndBrainCancer.org.

# SECTION 4: How to Get NGS Testing in the United States

NGS testing for cancer patients in the United States is available through several pathways: commercial laboratories, academic medical centers, NCI-designated cancer centers, hospital-based labs, pediatric specialty centers, and through certain clinical trials. This section provides a comprehensive overview of all major options.

**Important: Your Doctor Must Order the Test**

In the United States, NGS testing must be ordered by a licensed physician. Patients cannot order these tests directly. If your current oncologist has not ordered NGS testing, you can ask them to, or you can seek a second opinion at a major cancer center. If you need help advocating for NGS testing, contact EBCI at EndBrainCancer.org.

## 4.1 Commercial (For-Profit) Laboratories

Commercial labs are private companies that offer NGS testing services nationwide. Your doctor can send your tumor tissue sample directly to these companies. They typically provide results in 2 to 3 weeks, work with insurance companies to help cover costs, and most offer financial assistance programs for patients with limited insurance or high out-of-pocket costs.

All commercial labs listed below are CLIA-certified and CAP-accredited unless otherwise noted.

**CLIA** (Clinical Laboratory Improvement Amendments) is a federal regulatory program administered by the Centers for Medicare & Medicaid Services (CMS) certifies clinical laboratories that meet quality and proficiency standards for testing on human specimens.

**CAP** (College of American Pathologists) accreditation is a voluntary, peer-reviewed inspection program widely regarded as the gold standard for laboratory quality assurance and is accepted by many insurers and health systems as evidence of the highest level of laboratory performance.

Together, CLIA certification and CAP accreditation ensure that a laboratory's NGS tests meet rigorous analytical accuracy, validation, and quality control standards important factors when choosing where to have your tumor tested.

### Tier 1: Major National Commercial Labs (Broad Solid Tumor NGS Panels)

| Lab / Test Name | Test Type & Scope | Brain Tumor Relevance | How to Access |
|---|---|---|---|
| **Foundation Medicine** | FoundationOne CDx (324+ genes, tissue) & FoundationOne Liquid CDx (blood). FDA-approved. | Yes, includes IDH1/2, H3 K27M, EGFR, NTRK, MGMT, TMB, MSI. | Ordered by physician. foundationmedicine.com. Phone: 1-888-988-3639. Email: client.services@foundationmedicine.com. Financial assistance available. |
| **Tempus AI** | xT CDx (648 genes, tissue), xF (liquid biopsy), xR (RNA). AI-powered trial matching included. | Yes, comprehensive brain tumor markers. RNA panel detects fusions. | Ordered by physician. tempus.com. Phone: 1-800-739-4137. Email: support@tempus.com. Financial assistance at access.tempus.com. |
| **Caris Life Sciences** | MI Profile (650+ genes, tissue). DNA and RNA profiling. Comprehensive genomic profiling with trial matching included in report. | Yes, includes IDH1/2, H3 K27M, EGFR, BRAF, NTRK, MGMT, TMB, MSI. Strong brain tumor profiling. | Ordered by physician. carislifesciences.com. Phone: 1-888-979-8669. Email: CustomerSupport@CarisLS.com. Financial assistance available for eligible patients. |
| **NeoGenomics** | Neo Comprehensive (500+ tests). Tissue and liquid biopsy NGS. DNA and RNA panels. Multiple US lab locations. | Yes, solid tumor and hematologic panels; includes IDH1/2, EGFR, BRAF, NTRK, H3 K27M, TMB, MSI. | Ordered by physician. neogenomics.com. Labs in FL, TX, TN, CA, NJ, and more. Financial assistance available. |
| **Labcorp Oncology** | Broad genomic profiling; 521-gene Reveal ctDNA liquid biopsy panel; tissue and blood-based NGS. Biomarker and companion diagnostic testing. | Yes, solid tumor panels covering IDH1/2, EGFR, BRAF, NTRK, MGMT, TMB, MSI; companion diagnostics for targeted therapies. | Ordered by physician. oncology.labcorp.com. Phone: 1-800-447-5816 (Shelton/NY clients) or 1-866-875-2271 (Brentwood/Phoenix clients). Financial assistance available. Works with most insurance plans. |

| Lab / Test Name | Test Type & Scope | Brain Tumor Relevance | How to Access |
|---|---|---|---|
| **Quest Diagnostics** | Solid tumor NGS panels; one of the largest national lab networks; broad insurance acceptance nationwide; hereditary cancer risk panels also available. | Yes, solid tumor profiling panels covering major brain tumor markers; hereditary panels for predisposition syndromes (NF1, NF2, TP53). | Ordered by physician. questdiagnostics.com. Phone: 1-866-697-8378 (physician inquiry line). Nationwide collection sites. Broad insurance acceptance. Contact via questdiagnostics.com/contact-us for oncology inquiries. |
| **Myriad Genetics (Precise Tumor)** | Precise Tumor: comprehensive DNA, RNA, and immuno-oncology biomarker profiling for advanced solid tumors; integrates with germline testing. | Yes, somatic and germline integration; solid tumor including CNS tumors; TMB, MSI, HRD, fusions. | Ordered by physician. myriad.com. Phone: 1-800-469-7423. Email: myriad@myriad.com. Most patients have no out-of-pocket costs per Myriad data. Financial assistance program available. |
| **Exact Sciences (oncoExTra)** | oncoExTra: combined genomic (DNA) and transcriptomic (RNA) profiling for advanced, aggressive, rare, and recurrent cancers. | Expanding. Well-suited for complex and rare tumors. Confirm current brain tumor panel coverage directly with lab. | Ordered by physician. exactsciences.com. Phone: 1-866-662-6897. Email: oncoextra@exactsciences.com. Financial assistance may be available; confirm with lab at time of order. |
| **Guardant Health (Guardant360)** | Liquid biopsy (blood); 70+ gene panel. FDA-approved. TissueNext tissue-based NGS test also available (added 2024). | Limited for primary brain tumors. Brain tumors shed low levels of ctDNA into the bloodstream. May be useful in certain situations at recurrence. | Ordered by physician. guardanthealth.com. Phone: 1-855-698-8887 (Client Services). Financial assistance available. Liquid biopsy may be ordered when tissue is unavailable. |

## Tier 2: Specialized & Regional Commercial Labs

### EBCI Partner Spotlight: Belay Diagnostics (CSF-Based NGS Exclusively for Brain Tumors)

Belay Diagnostics offers Summit™ 2.0, the only comprehensive NGS test performed on cerebrospinal fluid (CSF), not blood or tissue, specifically designed for CNS malignancies. Because the blood-brain barrier prevents brain tumor DNA from reaching the bloodstream, standard blood-based liquid biopsies are unreliable for brain tumors. CSF, collected via a lumbar puncture (spinal tap), bypasses this barrier and provides tumor-derived DNA directly from the brain and spine environment. Summit™ 2.0 detects SNVs, indels, CNVs, gene fusions, splice variants, MSI, and TMB in a single assay. It is especially valuable when tumor tissue biopsy is not safe or feasible (e.g., brainstem or deep midline tumors). Clinically validated and published in peer-reviewed literature (2026); academic collaboration with Johns Hopkins. Belay is an EBCI Clinical Trial Partner. Website: belaydx.com | Based in Chicago, IL.

| Lab / Test Name | Test Type & Scope, Brain Tumor Relevance & Access |
|---|---|
| **Belay Diagnostics Summit™ 2.0 (EBCI Partner)** | CSF (cerebrospinal fluid) liquid biopsy NGS is the only comprehensive genomic profiling test designed specifically for CNS tumors using CSF. Detects SNVs, indels, CNVs, fusions, splice variants, MSI, and TMB. Ideal when tissue biopsy is not safe or feasible. Ordered by physician. Chicago, IL. EBCI Clinical Trial Partner. Customer Rep: aecker@belaydiagnostics.com and amanewith@belaydiagnostics.com |
| **Genomic Testing Cooperative (GTC)** | Comprehensive DNA & RNA; solid tumor and hematologic panels; liquid biopsy. ~7-day turnaround. Includes TMB, MSI, HRD, fusions, CNV. genomictestingcooperative.com \| 949-540-9421 |
| **Ambry Genetics (TumorNext, CancerNext)** | Tissue somatic NGS and hereditary cancer panels; paired tumor-germline testing available. Useful when inherited syndrome suspected. ambrygen.com |
| **Invitae (now part of Labcorp)** | Germline (hereditary) NGS multi-gene cancer panels; >99% analytical sensitivity. For NF1, NF2, Li-Fraumeni (TP53), Lynch and other inherited syndromes. invitae.com |
| **ARUP Laboratories** | Solid Tumor Mutation Panel by NGS; hematologic malignancy panels; CLIA/CAP; University of Utah-affiliated national reference lab. aruplab.com \| 1-800-242-2787 |
| **Fulgent Genetics / Fulgent Oncology** | Pan-cancer NGS panels (150+ genes); hereditary and somatic testing; 7 labs across the U.S. Acquired CSI Laboratories and StrataDx. fulgentoncology.com |

| Lab / Test Name | Test Type & Scope, Brain Tumor Relevance & Access |
|---|---|
| **Myriad Genetics MyRisk Hereditary** | MyRisk: 35+ gene hereditary cancer panel; integrates germline risk scoring. Relevant for NF1, NF2, TP53, PTEN brain tumor predisposition. myriad.com |
| **Sonic Healthcare USA / ProPath** | AuraSeq test family; FFPE and cytology-compatible NGS panels; multiple US laboratory sites. sonichealthcareusa.com |
| **Chronetyx Laboratories** | Cyx Solid Tumor 505 (FDA-cleared, CE-IVD); 505-gene panel; rapid turnaround via GenomOncology bioinformatics platform. chronetyx.com |
| **GeneDx** | Broad hereditary cancer and rare disease NGS panels; CLIA/CAP/NY-certified. genedx.com |
| **Baylor Genetics** | Somatic and germline NGS; hereditary cancer panels; CLIA/CAP/NY-certified. baylorgenetics.com |
| **PreventionGenetics (Exact Sciences)** | Hereditary cancer NGS; RiskGuard panel for inherited cancer risk prediction. preventiongenetics.com |
| **Natera (Signatera)** | Tumor-informed liquid biopsy (ctDNA); personalized MRD and recurrence monitoring. Relevant for post-treatment surveillance. natera.com |
| **Veracyte** | Expanding oncology genomic portfolio; Afirma (thyroid) and Decipher platforms. Primarily thyroid cancer; confirm brain tumor coverage. veracyte.com |
| **Personal Genome Diagnostics / PGDx (Labcorp)** | Tissue and liquid biopsy comprehensive genomic profiling; Elio platforms; now part of Labcorp. labcorp.com |

### 4.2 Academic Medical Centers & NCI-Designated Cancer Centers

Many major academic hospitals and all NCI-designated cancer centers offer in-house NGS testing, often with dedicated molecular tumor boards that review results with your care team. Testing at these centers may be ordered as part of your standard-of-care workup. These are non-commercial options, and coverage depends on your institution and insurance plan.

## Major NCI-Designated Centers with Dedicated Neuro-Oncology Programs

| Center | Location | NGS / Molecular Platform | Contact |
|---|---|---|---|
| **Dana-Farber Cancer Institute** | Boston, MA | Dedicated neuro-oncology; comprehensive molecular profiling. Center for Neuro-Oncology (Dr. Patrick Wen). | dfci.harvard.edu \| Neuro-Oncology: 617-632-2166 \| Referring physicians: 617-632-3703 \| Email: dfci_globalhealth@dfci.harvard.edu |
| **Memorial Sloan Kettering (MSK)** | New York, NY | MSK-IMPACT (505+ gene panel); FDA-approved; in-house neuro-oncology. | mskcc.org \| Brain Tumor Center: 212-639-6767 \| Referring physicians: 646-677-7440 (24/7) \| Email: brainctr@mskcc.org |
| **MD Anderson Cancer Center** | Houston, TX | Moonshot and precision oncology programs; central specimen testing for NCI trials. | mdanderson.org \| Phone: 1-877-632-6789 \| Referring physicians: 1-877-632-6789 (option 1) |
| **Duke University Preston Robert Tisch Brain Tumor Center** | Durham, NC | Dedicated brain tumor center; molecular profiling integrated into care. EBCI partner institution. | tischbraintumorcenter.duke.edu \| Phone: 919-684-5301 \| Referring physicians: 1-800-433-5953 |
| **UCLA Jonsson Comprehensive Cancer Center** | Los Angeles, CA | Strong neuro-oncology and molecular profiling program. | uclahealth.org \| Phone: 310-825-5111 \| Neuro-Oncology: 310-825-5321 |
| **UCSF Helen Diller Family Cancer Center** | San Francisco, CA | Well-known brain tumor program; in-house genomic profiling. | ucsf.edu \| Neuro-Oncology: 415-353-2966 \| Appointments: 888-689-8273 |
| **Mayo Clinic Laboratories (MayoComplete)** | Rochester, MN; Phoenix, AZ; Jacksonville, FL | MayoComplete Solid Tumor Panel (518 genes, DNA + RNA). Dedicated neuro-oncology NGS panel; 1,445-gene RNA transcriptome. | mayocliniclabs.com \| Phone: 1-800-533-1710 \| Email: mayocliniclabs@mayo.edu |

| Center | Location | NGS / Molecular Platform | Contact |
|---|---|---|---|
| **Johns Hopkins Sidney Kimmel Cancer Center** | Baltimore, MD | Molecular diagnostics and neuro-oncology expertise. | hopkinsmedicine.org \| Phone: 410-955-5000 \| Neuro-Oncology: 410-955-8837 |
| **Massachusetts General Hospital (MGH)** | Boston, MA | MGH Cancer Center; OncoPanel in-house NGS. Partners HealthCare network. | massgeneral.org \| Phone: 617-726-2000 \| Neuro-Oncology: 617-726-3650 |
| **University of Michigan Rogel Cancer Center (MLabs)** | Ann Arbor, MI | Solid Tumor NGS Panel (DNA + RNA, 50 genes). CLIA-certified academic lab. | mlabs.umich.edu \| Phone: 734-936-6759 \| Email: mlabs-info@umich.edu |
| **Stanford Cancer Institute** | Stanford, CA | NCI-designated; precision oncology and genomic profiling. Strong neuro-oncology program. | stanfordhealthcare.org \| Phone: 650-723-6469 \| Neuro-Oncology: 650-723-8631 |
| **Cleveland Clinic Genomic Medicine Institute** | Cleveland, OH | Comprehensive genomic profiling; hereditary and somatic testing. | clevelandclinic.org \| Phone: 216-444-2200 \| Neuro-Oncology: 216-444-5977 |
| **Northwestern Medicine Robert H. Lurie Cancer Center** | Chicago, IL | 500+ gene in-house panel (Northwestern Memorial). NCI-designated. | cancer.northwestern.edu \| Phone: 312-695-0990 \| Neuro-Oncology: 312-695-0990 |
| **University of Texas Southwestern Harold C. Simmons Cancer Center** | Dallas, TX | NCI-designated; molecular profiling and precision oncology programs. | utsouthwestern.edu \| Phone: 214-648-3111 \| Neuro-Oncology: 214-645-2636 |
| **Vanderbilt-Ingram Cancer Center** | Nashville, TN | NCI-designated; VICC molecular profiling; neuro-oncology program. | vicc.org \| Phone: 615-936-8422 \| Appointments: 800-811-8480 |
| **Washington University Siteman Cancer Center** | St. Louis, MO | NCI-designated. Pioneer in cancer genomics; McDonnell Genome Institute. | siteman.wustl.edu \| Phone: 314-747-7222 \| Referring physicians: 866-867-3627 |

| Center | Location | NGS / Molecular Platform | Contact |
|---|---|---|---|
| **University of Colorado Cancer Center** | Aurora, CO | NCI-designated; molecular profiling and genomics. Pediatric and adult programs. | coloradocancercenter.org \| Phone: 720-848-0300 \| Neuro-Oncology: 720-848-2080 |
| **Moffitt Cancer Center** | Tampa, FL | NCI-designated; dedicated neuro-oncology; precision medicine program. | moffitt.org \| Phone: 888-663-3488 \| Neuro-Oncology: 813-745-4673 |
| **Yale Cancer Center** | New Haven, CT | NCI-designated; in-house molecular profiling. | yalecancercenter.org \| Phone: 203-785-4191 \| Neuro-Oncology: 203-785-2489 |
| **University of Pennsylvania Abramson Cancer Center** | Philadelphia, PA | NCI-designated; Penn Precision Medicine. Strong brain tumor program. | oncolink.org \| Phone: 215-662-6364 \| Neuro-Oncology: 215-662-7854 |
| **UC San Diego Moores Cancer Center** | La Jolla, CA | NCI-designated; precision oncology and molecular profiling. | health.ucsd.edu/cancer \| Phone: 858-657-7000 \| Neuro-Oncology: 858-657-5315 |
| **City of Hope Comprehensive Cancer Center** | Duarte, CA | NCI-designated; genomic profiling and molecular diagnostics. | cityofhope.org \| Phone: 800-826-4673 \| Neuro-Oncology: 626-218-2273 |
| **Fred Hutchinson Cancer Center** | Seattle, WA | NCI-designated; genomics and precision medicine. Strong research programs. | fredhutch.org \| Phone: 206-667-5000 \| Appointments: 206-606-1024 |
| **Ohio State University OSUCCC James** | Columbus, OH | NCI-designated; molecular profiling and brain tumor program. | cancer.osu.edu \| Phone: 800-293-5066 \| Neuro-Oncology: 614-293-8056 |
| **University of North Carolina Lineberger Cancer Center** | Chapel Hill, NC | NCI-designated; molecular diagnostics. | unclineberger.org \| Phone: 984-974-8200 \| Neuro-Oncology: 984-974-8416 |

There are 74 NCI-designated cancer centers across the U.S. (as of 2026). Most offer some form of molecular tumor profiling. Find one near you at: cancer.gov/research/nci-role/cancer-centers/find

### 4.3 Pediatric Specialty Centers for Brain Tumor NGS Testing

Brain tumors, including DMG/DIPG, disproportionately affect children and young adults. The following pediatric centers offer specialized NGS testing and molecular profiling programs with dedicated pediatric neuro-oncology expertise.

| Center | Location | NGS / Pediatric Program Highlights | Contact |
|---|---|---|---|
| **St. Jude Children's Research Hospital** | Memphis, TN | SJPedPanel, custom pediatric cancer NGS panel. Genomes for Kids (G4K) program offers whole-genome sequencing. Pediatric Cancer Genome Project pioneer. | stjude.org \| Physician/Patient Referral: 1-888-226-4343 \| Email: referralinfo@stjude.org |
| **Children's Hospital of Philadelphia (CHOP)** | Philadelphia, PA | Division of Genomic Diagnostics: NGS panels, cancer transcriptome (RNA-seq), single-gene and somatic panels. World-renowned pediatric cancer program. | chop.edu \| Physician-only referral line: 888-ONC-CHOP (888-662-2467) \| After hours: 215-590-1000 |
| **Cincinnati Children's Hospital Medical Center** | Cincinnati, OH | Cure Starts Now Brain Tumor Center; dedicated DIPG and DMG research and clinical molecular profiling. | cincinnatichildrens.org \| Phone: 513-636-4200 \| Neuro-Oncology: 513-636-4266 |
| **Texas Children's Hospital / Baylor College of Medicine** | Houston, TX | Pediatric neuro-oncology; Baylor Genetics laboratory; molecular profiling integrated into clinical care. | texaschildrens.org \| Phone: 832-824-1000 \| Neuro-Oncology: 832-822-4266 |
| **Children's Hospital Los Angeles (CHLA)** | Los Angeles, CA | Pediatric brain tumor and neuro-oncology; molecular testing and clinical trials access. | chla.usc.edu \| Phone: 323-660-2450 \| Neuro-Oncology: 323-361-4629 |
| **Nationwide Children's Hospital** | Columbus, OH | Pediatric cancer genomics; molecular diagnostics laboratory. | nationwidechildrens.org \| Phone: 614-722-2000 \| Neuro-Oncology: 614-722-3551 |
| **Boston Children's Hospital Dana-Farber** | Boston, MA | Dana-Farber/Boston Children's Cancer and Blood Disorders Center; comprehensive molecular profiling for pediatric brain tumors. | dana-farber.org/boston-childrens \| Phone: 617-632-3650 \| Referrals: 617-632-3703 |

| Center | Location | NGS / Pediatric Program Highlights | Contact |
|---|---|---|---|
| **Ann & Robert H. Lurie Children's Hospital of Chicago** | Chicago, IL | Pediatric neuro-oncology; molecular diagnostics; affiliated with Northwestern. | luriechildrens.org \| Phone: 312-227-4000 \| Neuro-Oncology: 312-227-4090 |
| **Children's National Hospital** | Washington, D.C. | Brain Tumor Institute; comprehensive molecular diagnostics; pediatric DMG/DIPG clinical expertise. | childrensnational.org \| Phone: 202-476-5000 \| Brain Tumor Institute: 202-476-5980 |
| **Seattle Children's Hospital** | Seattle, WA | Pediatric brain tumor program; molecular profiling; affiliated with Fred Hutchinson Cancer Center. | seattlechildrens.org \| Phone: 206-987-2000 \| Neuro-Oncology: 206-987-2106 |
| **Lurie Children's / Ann & Robert H. Hospital** | Chicago, IL | Pediatric oncology genomics; molecular diagnostic laboratory. | luriechildrens.org \| Phone: 312-227-4000 \| Neuro-Oncology: 312-227-4090 |
| **Children's Hospital Colorado** | Aurora, CO | Morgan Adams Foundation Pediatric Brain Tumor Research Program; molecular profiling. | childrenscolorado.org \| Phone: 720-777-1234 \| Neuro-Oncology: 720-777-6798 |
| **UCSF Benioff Children's Hospital** | San Francisco, CA | Pediatric neuro-oncology; PBTC (Pediatric Brain Tumor Consortium) member; genomic profiling. | ucsfbenioffchildrens.org \| Phone: 415-476-1000 \| Neuro-Oncology: 415-353-2966 |
| **Rady Children's Hospital San Diego** | San Diego, CA | Pediatric cancer genomics; Rady Children's Institute for Genomic Medicine. | rchsd.org \| Phone: 858-576-1700 \| Oncology: 858-966-5811 |

### 4.4 Additional Hospital & Health System Labs

Many major hospital systems and large health networks operate their own in-house molecular pathology laboratories. These labs perform NGS for patients seen within their systems. If you receive care at a large hospital or academic health system, ask your oncologist whether in-house NGS testing is available.

| Institution / System | Location(s) | Notes |
|---|---|---|
| **Cleveland Clinic Health System** | Cleveland, OH (+ regional) | Genomic Medicine Institute; somatic and germline testing; molecular tumor board. |
| **Mayo Clinic Laboratories** | Rochester, MN; Phoenix, AZ; Jacksonville, FL | Reference lab also accepts send-out specimens from other institutions nationwide. mayocliniclabs.com. |
| **ARUP Laboratories** | Salt Lake City, UT (national reference lab) | University of Utah–affiliated national reference laboratory. Solid tumor NGS panel available to physicians nationwide. |
| **University of Michigan MLabs** | Ann Arbor, MI (national reference lab) | Solid Tumor NGS Panel accepted as send-out from physicians nationally. mlabs.umich.edu. |
| **Northwestern Medicine (in-house)** | Chicago, IL | 500+ gene in-house panel at Northwestern Memorial. Standard of care for all solid tumor patients. |
| **Stanford Health Care Molecular Pathology** | Stanford, CA | In-house genomic profiling for Stanford patients and external send-outs. |
| **NYU Langone Health Perlmutter Cancer Center** | New York, NY | NCI-designated; in-house NGS and molecular diagnostics. |
| **Mount Sinai Tisch Cancer Institute** | New York, NY | NCI-designated; comprehensive genomic profiling. |
| **Cedars-Sinai Cancer Center** | Los Angeles, CA | Strong neuro-oncology and in-house molecular testing. |
| **Sentara Healthcare Laboratory Services** | Norfolk, VA | In-house Solid Tumor NGS Panel (9-gene panel + broader profiling options). |
| **Alverno Laboratories** | Harvey, IL | In-house Solid Tumor NGS Panel (52-gene panel). |
| **ProPath / Sonic Healthcare USA** | Dallas, TX (national) | AuraSeq NGS panels; FFPE-compatible; serves oncologists nationally. |

### 4.5 Through a Clinical Trial

If you are enrolled in or being screened for certain clinical trials, NGS testing may be provided at no cost as part of the trial protocol. This is one of the most important benefits of clinical trial participation.

- The NCI ComboMATCH trial program matches patients to targeted drug combinations based on NGS results, with testing performed at a network of CLIA-certified designated labs.
- Many pharmaceutical-sponsored trials from companies like Black Diamond Therapeutics, Curis, and Nuvation Bio include NGS-based screening as part of enrollment.
- Academic trials at NCI-designated centers often include molecular profiling at no charge to the patient.

Ask your oncologist or a patient navigator whether any open trials you might qualify for include complimentary NGS testing.

### 4.6 Insurance Coverage and Financial Assistance

| Coverage Type | What You Need to Know |
|---|---|
| **Medicare** | Medicare may cover NGS testing for certain cancer diagnoses. Coverage typically requires that the test is FDA-approved or meets specific clinical criteria. Ask your doctor to submit a prior authorization request. |
| **Private / Commercial Insurance** | Coverage varies by plan. Many major insurers cover FDA-approved NGS panels for solid tumors, particularly for patients with advanced or metastatic cancer. Your lab will often handle prior authorization. |
| **Medicaid** | Coverage varies by state. Some states have expanded Medicaid coverage for molecular testing. Check with your state's Medicaid office or a patient navigator. |
| **Financial Assistance Programs** | Most major commercial labs (Foundation Medicine, Tempus, Caris, NeoGenomics, Labcorp, Myriad) offer patient assistance programs that can reduce or eliminate out-of-pocket costs for eligible patients. |
| **EBCI Navigation Support** | EBCI can help you navigate insurance, identify financial assistance, and advocate for coverage. Contact us at EndBrainCancer.org. |

# SECTION 5: Questions to Ask Your Doctor

Asking the right questions can help ensure that you receive the most complete and personalized care. Below are questions you and your caregiver can bring to your next appointment.

## 5.1 Questions About NGS Testing

- Has NGS or comprehensive molecular profiling been performed on my tumor? If not, why not and can it be ordered?
- Which specific mutations or biomarkers were found in my tumor? What do they mean?
- Did the results identify any FDA-approved targeted therapies that may be relevant to me?
- Are there clinical trials that I might qualify for based on my NGS results?
- If my tissue sample is old, is it still viable for NGS testing?
- Would a repeat biopsy or liquid biopsy provide additional useful information at this stage?
- Do I already have enough tissues stored from my previous surgery for NGS/Biomarker & Fusion Testing?
- Is a blood-based liquid biopsy a good option for my situation?
- Now that my tumor has recurred, should we repeat molecular testing?

## 5.2 Questions About Targeted Therapy

- Based on my molecular profile, is there any targeted therapy that might be appropriate for me?
- What are the potential benefits and side effects of targeted therapy compared to standard treatment?
- If I have H3 K27M-mutant DMG, am I eligible for Modeyso (dordaviprone)?

## 5.3 Questions About Clinical Trials

- Are there any clinical trials currently enrolling patients with my specific tumor type and mutation profile? Does any trial include complimentary NGS testing as part of screening?
- Can EBCI or another navigation service help me identify trials I might not be aware of?

# SECTION 6: Resources & Support

## 6.1 End Brain Cancer Initiative (EBCI)

EBCI is a nonprofit organization dedicated to improving outcomes for brain tumor patients through access to clinical trials, education, and personalized navigation. Our Patient and Resource Navigators can help you:

- Understand your NGS results and what they mean for your treatment options
- Identify clinical trials that match your tumor profile
- Navigate insurance, financial assistance, and NGS testing access
- Connect with specialists, academic cancer centers, and support networks

**www.EndBrainCancer.org**

## 6.2 Additional Resources

| Organization / Resource | What They Offer |
|---|---|
| **National Brain Tumor Society (NBTS)** | Patient education, advocacy, biomarker testing resources, and caregiver support. braintumor.org |
| **American Brain Tumor Association (ABTA)** | Disease-specific information, caregiver resources, and support programs. abta.org |
| **National Cancer Institute (NCI)** | Comprehensive cancer information, clinical trial search (clinicaltrials.gov), and precision medicine resources. cancer.gov |
| **ClinicalTrials.gov** | The official U.S. registry of clinical trials. Search by cancer type, mutation, location, and more. |
| **Jazz Pharmaceuticals Modeyso Patient Support** | Information and patient support resources for patients prescribed Modeyso (dordaviprone). Ask your oncologist about manufacturer patient assistance programs. |
| **NCI Cancer Information Service** | Call 1-800-4-CANCER (1-800-422-6237) for personalized help from cancer information specialists (English and Spanish). |

| Organization / Resource | What They Offer |
| --- | --- |
| **CERN Foundation** | Focused on ependymoma research and patient support; genomic testing resources. cern-foundation.org |
| **Pediatric Brain Tumor Foundation** | Resources and support for pediatric brain tumor patients and families. curethekids.org |
| **Musella Foundation for Brain Tumor Research & Information** | Patient education, clinical trial database (VirtualTrials.org), drug copayment assistance program, online support groups, brain tumor news, |

## GLOSSARY: Key terms used in this guide explained

| Term | Definition |
|---|---|
| **Biomarker** | A measurable feature of your tumor (such as a gene mutation) that gives doctors information about the tumor's behavior or treatment response. |
| **Biopsy** | A procedure in which a small sample of tissue is removed from the body for laboratory testing. |
| **Blood-Brain Barrier** | A protective layer of tightly packed cells that separates the brain and its blood supply from the rest of the bloodstream. This barrier is designed to keep harmful substances out of the brain but it also limits how much tumor DNA can escape into the blood. This is why standard blood-based liquid biopsies are generally less sensitive for brain tumor patients than for other cancer types, and why CSF-based or tissue-based testing is usually preferred. |
| **CGP (Comprehensive Genomic Profiling)** | A type of cancer test that uses NGS technology to simultaneously analyze hundreds of cancer-relevant genes in a single assay, detecting all major classes of genetic change (mutations, fusions, copy number changes, TMB, and MSI). CGP is what most oncologists mean when they say "NGS testing." NGS is the technology; CGP is the clinical test. Broad CGP panels are preferred over narrow single-gene tests for brain tumor patients. |
| **CSF (Cerebrospinal Fluid)** | The fluid that surrounds the brain and spinal cord. Because the blood-brain barrier prevents brain tumor DNA from reaching the bloodstream, CSF collected via lumbar puncture can be used as a liquid biopsy source for brain tumor genomic testing, as in Belay Diagnostics' Summit™ 2.0 test. |
| **DNA / RNA** | DNA carries your genetic instructions. RNA is a molecule that reads and carries out those instructions. Both can be tested through NGS. |
| **Diffuse Midline Glioma (DMG)** | A rare, aggressive brain tumor that grows in midline brain structures. Defined in part by the H3 K27M mutation. |
| **FFPE** | Formalin-Fixed Paraffin-Embedded tissue is the standard way tumor tissue is preserved in pathology labs. This preserved tissue is used for NGS testing. |

| Term | Definition |
| --- | --- |
| **Glioblastoma (GBM)** | The most common and most aggressive type of primary brain tumor in adults. |
| **H3 K27M mutation** | A specific genetic change found in diffuse midline glioma that drives the tumor's aggressive behavior. Required for eligibility for Modeyso (dordaviprone). |
| **IDH1 / IDH2** | Genes that, when mutated, are associated with lower-grade gliomas and generally a better prognosis. Also a target for emerging therapies. |
| **Liquid biopsy** | A test that looks for tumor DNA in body fluids rather than requiring a surgical tissue sample. For brain tumor patients, liquid biopsy can be performed two ways: (1) using a blood draw, which is convenient but generally less sensitive for brain tumors because the blood-brain barrier limits how much tumor DNA reaches the bloodstream; or (2) using cerebrospinal fluid (CSF) collected via a lumbar puncture or ventricular reservoir, which is typically more sensitive because CSF is in direct contact with the brain and spinal cord. A liquid biopsy may be useful when tissue is unavailable, for monitoring disease over time, or to detect recurrence. |
| **Lumbar Puncture (Spinal Tap)** | A minimally invasive procedure in which a needle is inserted into the lower part of the spine to collect a small sample of cerebrospinal fluid (CSF). In brain tumor patients, this fluid can contain tumor DNA and may be used for liquid biopsy testing. Because CSF is in direct contact with the brain and spinal cord, it often provides more tumor-derived DNA than a blood sample, making it a more sensitive option for brain tumor molecular testing. |
| **MGMT** | A gene whose promoter methylation predicts response to temozolomide (TMZ), the standard chemotherapy for GBM. |
| **Modeyso (dordaviprone)** | The first FDA-approved targeted therapy for H3 K27M-mutant diffuse midline glioma. Developed by Chimerix, now marketed by Jazz Pharmaceuticals. |
| **Mutation** | A change in the DNA sequence of a gene. In cancer, mutations can cause cells to grow abnormally. |
| **NGS (Next-Generation Sequencing)** | The laboratory technology that reads DNA or RNA at very high speed by sequencing millions of fragments simultaneously. NGS is the engine that powers Comprehensive Genomic Profiling (CGP) tests. Not all NGS tests are comprehensive. Some test only a small number of genes. See also: CGP. |

| Term | Definition |
| --- | --- |
| **Precision / Personalized medicine** | An approach to cancer treatment that uses the genetic profile of a patient's specific tumor to guide therapy choices. |
| **Stereotactic Needle Biopsy** | A minimally invasive surgical procedure that uses advanced imaging — such as MRI or CT to precisely guide a needle to a specific location in the brain to collect a small tumor tissue sample. This approach allows neurosurgeons to safely reach tumors in deep or hard-to-access areas, such as the brainstem or thalamus, without performing a full open surgery. Even a small sample collected this way can often provide enough material for comprehensive NGS/Biomarker & Fusion Testing. |
| **Targeted therapy** | A cancer treatment designed to attack a specific genetic mutation or abnormal protein driving tumor growth, rather than attacking all rapidly dividing cells. |
| **TMB (Tumor Mutational Burden)** | A measure of how many mutations are present in a tumor. High TMB may predict response to immunotherapy. |
| **Ventricular Reservoir (Ommaya Reservoir)** | A small device surgically placed under the scalp that connects to the fluid-filled spaces inside the brain (the ventricles). It is most commonly used to deliver medication directly to the brain or to collect cerebrospinal fluid (CSF) without requiring a lumbar puncture. In some cases, fluid collected through this device can be used for molecular and liquid biopsy testing, making it a convenient option for patients who already have one in place. |
| **WHO Classification** | The World Health Organization's official classification system for brain tumors, which now requires molecular markers (including NGS results) for a complete diagnosis. |

**NGS & Targeted Therapy Patient Guide**
Resources, support, and next steps for patients and caregivers

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# Still Have Questions? We're Here to Help.

EBCI can help patients and caregivers understand NGS results, identify relevant clinical trials, navigate testing access, and connect with brain tumor specialists and support resources.

**Understand Your Results**
Get help interpreting NGS findings, biomarkers, and what they may mean for treatment options.

**Find Clinical Trials**
Identify clinical trials that may match your tumor profile, location, and care goals.

**Navigate Next Steps**
Support with insurance questions, testing access, specialists, and academic cancer centers.

**Contact EBCI Patient Navigation**
Patient Navigator / Clinical Trial Coordinator:
**Shreya Prakash**
Email: **Shreya@EndBrainCancer.org**
Call or Text: **425-436-8688**
Patient Inquiry Form: **EndBrainCancer.org**

**Ways to Support EBCI Programs & Services**
Give online at **EndBrainCancer.org/donate**
Text **EBCI** to **366283**
Give by mail using the printable donation form
Your support helps expand education, navigation, and clinical trial access.

**Additional Resources**
National Brain Tumor Society (braintumor.org) | American Brain Tumor Association (abta.org) | National Cancer Institute (cancer.gov) | ClinicalTrials.gov | NCI Cancer Information Service: 1-800-4-CANCER

**Disclaimer:** This guide is intended for informational and educational purposes only. It does not constitute medical advice and is not a substitute for the advice, diagnosis, or treatment recommendations of a qualified healthcare provider. Treatment guidelines, drug approvals, and clinical trial availability change frequently. Always consult your neuro-oncologist or care team for current guidance.