Molecular Profiling: An Important Step for Personalized Cancer Treatment

Every Individual Has a Unique Genetic Code; Therefore, Their Cancer Is Also Unique

Cancer is often caused by one or more genes in your body that have changed (or mutated). These mutations trigger an uncontrolled growth of abnormal (cancer) cells. Each cancer cell contains a copy of the mutated gene. For some cancers, the genetic mutation causing it is similar from person to person. But sometimes, cancers are driven by unique mutations that vary from person to person.

Over the last two decades, new technology has made it possible to look very closely inside each person's tumors to see exactly which mutations are present. This kind of detailed tumor study is called **molecular profiling**. With the information it provides, your doctor may be able to better tailor or personalize your treatment plan.

Genetic studies look at a *person's* genes in general, to help identify their inherited risk of cancer and other diseases.

Molecular (or genomic) studies look at a *tumor's* specific genes, to search for mutations that can drive cancer growth and spread and to help determine how best to treat it.

Benefits of Molecular Profiling

Molecular profiling has also helped scientists better understand how cancer can start, grow, and spread in the body. These insights are leading to exciting new treatments. Some drugs can precisely target and disrupt mutation-related malfunctions in the body that drive cancers. If you undergo molecular profiling, for instance, your doctor can determine if your tumor has any "actionable" mutations—meaning there is a targeted therapy available to treat it.

How Molecular Profiling Works

1. A sample from your tumor is sent to a special laboratory. The technicians there perform one or more molecular profiling tests to search for the unique biomarkers in your tumor. Biomarkers can be genes or other molecules that signal a certain process or disease at work.
2. Your biomarker profile (which lists the types and levels of your cancer's biomarkers) is then compared to a large database of published studies by the world's leading cancer researchers. This step helps to identify treatments that research has shown your cancer is likely, or unlikely, to respond to.
3. Your doctor receives this report and can use it to develop a personalized treatment plan for your cancer.

The latest technology—called next-generation sequencing (NGS)—has made molecular profiling faster and easier. It can test one tumor sample for thousands of genetic mutations and treatment targets at one time. Traditional sequencing approaches, like fluorescence *in situ* hybridization (FISH), can only look for one treatment target at a time in a tumor sample.

TISSUE BIOPSY VS LIQUID BIOPSY

For molecular profiling, a sample taken from your tumor (*a tissue biopsy*) is ideal for detecting and obtaining information about your cancer. Sometimes a tissue biopsy isn't possible because of the size or the location of your tumor. Another option, called a *liquid biopsy*, tests bits of material—like molecules or whole cells—that your tumor sheds into the blood, urine, or other body fluids. For some cancers, liquid biopsies can be used today to test for *some* of the same molecular features of cancer as tissue biopsies.

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About Cholangiocarcinoma

Cholangiocarcinoma (ko-LAN'-jee-o-car-sin-O'-ma) is cancer that forms in your bile ducts and is also known as bile duct cancer. Bile ducts are the thin tubes that connect your liver, gallbladder, and small intestine. Their job is to carry the digestive fluid known as bile, which is made in your liver and helps break down fats.

This type of cancer is not common. Having certain gastrointestinal, bowel, or liver diseases can increase the risk for cholangiocarcinoma. In most cases, this cancer starts in cells lining the bile ducts.

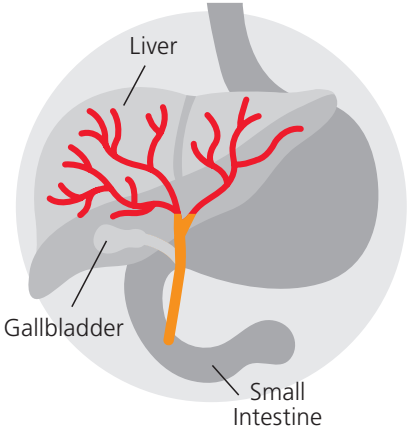
Did you know?

Many research centers around the world are investigating new ways to treat bile duct cancer—including new surgical techniques, improved ways to use radiation and chemotherapy, novel targeted therapies aimed at halting cancer cell growth, and combinations of these. According to the American Cancer Society, most experts agree that treatment in a clinical trial should be considered for bile duct cancers.

Doctors divide cholangiocarcinoma, or bile duct cancer, into different types based on where it occurs. The location of cholangiocarcinoma may affect how it is treated.

Intrahepatic means the cancer affects the bile ducts *inside* your liver.

Extrahepatic means the cancer affects the bile ducts *outside* your liver nearer the intestine.



These organizations support cholangiocarcinoma awareness, advocacy, and research.

TargetCancer Foundation
targetcancerfoundation.org
617-765-4881

cholangiocarcinoma FOUNDATION
cholangiocarcinoma.org
888-936-6731

THE BILI PROJECT FOUNDATION
thebiliproject.org
855-277-2454

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What Is Cancer?

There are more than 100 types of cancer—usually named for the organ or tissues where the cancer starts growing. Cancer is caused by certain changes in your genes that control the way your body's cells function, especially how they grow and divide.

A healthy body has cells that are constantly growing and dividing to form new cells as your body needs them. It's a constant cycle. As cells get old or damaged, they usually die and new healthy cells take their place.

When cancer develops, however, it means this normal, healthy cycle is broken. Genetic mutations cause abnormal new cells to keep forming and dividing without stopping. These abnormal cells may form solid growths called tumors.

Did you know?

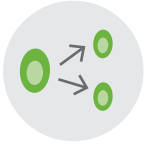
- **Some cancers start due to gene changes that happen over a person's lifetime. These genetic changes can be a result of errors when body cells divide or damage caused by cancer-causing chemicals or radiation**
- **Some cancers start due to inherited genetic mutations passed down in families**

When Cancer Spreads

Sometimes, cancer cells spread into surrounding tissues. Cancer cells can also break off of tumors where they first formed and travel through the blood or lymphatic system bringing cancer to other parts of your body.

A cancer that spreads from the place where it started to another part of the body is called metastatic cancer.

Metastatic cancer has the same name as the cancer in its original site. For example, breast cancer that spreads to the lung is called metastatic breast cancer, not lung cancer.



Healthy cells divide to form new cells

Cancer starts when cells change abnormally

Cancer grows as cells multiply over and over

Cancer cells can detach and spread to other parts of the body

Healthy cell

Cancer cell

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Types of Cancer Treatments

In addition to surgery and radiation, your doctor's toolkit should include many new and traditional medicines for fighting cancer today. Sometimes, one or more are used together as combination therapy. Some of the options include:

Chemotherapy: Drugs designed to destroy all rapidly dividing cells, whether they're healthy or cancerous, to slow or stop cancer growth.

Targeted Therapies: Treatments that target certain parts of your cells—such as genes or certain proteins—that are fueling cancer tumor growth. Targeted therapies block their actions, so cancer cells struggle to survive.

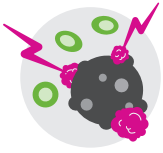
Immunotherapy: Biologic treatments (made from living organisms) that help your own immune system fight cancer—either by powering it up or by marking cancer cells so they're easier for your immune system to "see" and destroy.

Not all cancer treatments are appropriate for all patients. Be sure to consult your healthcare professional.

As with all prescription treatments, cancer treatments are studied in **clinical trials** before they can be approved by the US Food and Drug Administration (FDA) for doctors to prescribe.

Chemotherapy
Treatments designed to destroy all rapidly dividing cells, healthy or cancerous

Targeted Therapies
Treatments that target certain tumor cell parts that are fueling cancer growth



Immunotherapy
Biologic treatments that help your own immune system fight cancer

Molecular profiling—which identifies the unique mutations in a person's tumor—can be an important step for creating a personalized cancer treatment plan. Consult with your oncologist about treatment options for your tumor.

Why Join a Clinical Trial

If you're eligible, being part of a clinical trial may include:

- Access to potential new medicines that are being developed but aren't yet available for doctors to prescribe
- An experienced team of healthcare professionals who closely monitor and care for your condition
- The ability to help make a difference for other people who have your specific type of cancer

Clinical Trial Basics

Clinical trials are strictly regulated to protect your safety and privacy. Before any drug can be studied in humans, it first goes through extensive testing in labs (on cells and animals). On average, a new cancer drug is studied for at least 6 years before it gets to a clinical trial, to help ensure it's both effective and safe. As with any decision that affects your health, it's important to discuss the benefits and risks of clinical study participation with your healthcare professional.

Clinical trials may involve the potential for additional visits to the study site and may have certain risks, including potential side effects.

To search for a clinical trial, visit:
Clinicaltrials.gov

Clinical Trials Have Various Phases:

Phase 1: Focuses on safety issues like side effects, dosages, and how the drug works in the body. Lasts several months.

Phase 2: Includes people who typically have the disease for which the drug is being developed. Focuses on safety and also how well the drug works on the disease. Lasts several months to 2 years.

Phase 3: Focuses more closely on how well the drug works in a specific group of people and any side effects. Usually takes years to complete.

Depending on the results of a Phase 2 or 3 clinical trial, pharmaceutical manufacturers can request FDA approval of a drug to let doctors prescribe it.

Oncology Clinical Trial Measurements May Include:

ORR: objective response rate—the percentage of patients given a new treatment whose tumor shrinks or disappears by a certain amount within a defined period of time

PFS: progression-free survival—how long a person keeps living without their cancer getting worse after starting a new treatment

OS: overall survival—how long a person keeps living after starting a new treatment

Molecular Profiling and Personalized Treatment Plans: Talking to Your Healthcare Team

Starting a conversation with your oncologist or other healthcare professionals about molecular profiling can help you understand all your current treatment options.

To help you start the conversation, here are some questions you might ask:

- What can you tell me about molecular profiling for my type of cancer?
- What treatment options could molecular profiling offer me?
- How can I find out about treatment options that may be right for my cancer?
- I'd like to learn about any clinical trials I might be eligible for. Where would we start?

Because cancer is such a robust area for new research and development today, your healthcare professional may even need to take a little time to review the latest research findings and answer your questions—so he or she can make a well-informed recommendation as to how to treat your cancer. New insights about how best to treat different cancers are evolving quickly!

Notes for Your Next Office Visit

Glossary

Genetic mutation is a permanent change in a gene that makes it different from what's found in most people. A mutation can be inherited from a parent or acquired during a person's life. When mutations happen to genes that control how the body's cells normally grow and divide, it can lead to cancer.

Molecular profiling is a detailed study of a tumor sample, to see what genetic mutations it has inside it that may be driving the cancer. This is a type of *genomic testing*.

Genomic testing looks for any harmful changes (or mutations) that have occurred in the genetic code of your cells and that may cause cancer to grow and spread.

Actionable mutation refers to a mutated gene that has been identified in a cancer tumor and that can be treated with a currently available drug. Right now, molecular profiling studies can often see mutations for which treatments aren't yet available or are currently being studied.

Rare cancer is a type that occurs in fewer than 15 out of 100,000 people each year.

Chemotherapy is a class of drugs designed to destroy all rapidly dividing cells, whether they're healthy or cancerous, to slow or stop cancer growth.

Targeted therapies are treatments that target certain parts of your cells—like genes or certain proteins—that are fueling cancer tumor growth. These drugs block their actions, so cancer cells are less able to survive.

Immunotherapy is a form of biologic treatment (made from living organisms) that can help your own immune system fight cancer—either by powering it up or by marking cancer cells so they're easier for your immune system to "see" and destroy.

Clinical trials are research studies on people, often to see if new drugs are safe and effective for different health conditions. Being part of a clinical trial is a way to access new drugs being developed.

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