

Targeted Therapy and Biomarker Testing for Lung Cancer



If you or someone you love has lung cancer, this booklet can help you learn about treatments called targeted therapies. For some subtypes of lung cancer, targeted therapy can be more effective and cause fewer side effects. Targeted therapy drugs "target" specific changes found in some cancers that cause them to grow, divide, and spread. Targeted therapy for lung

cancer is most often used on its own, but may be combined with other treatments.

Targeted therapy is not for everyone. Read on to learn more about targeted therapy and the biomarker tests you need to find out if it may be right for you. For information about other kinds of lung cancer treatments, including immunotherapy and chemotherapy, visit www.CancerSupportCommunity.org/Lung.





TALKING ABOUT CANCER

Ask your health care team to explain any words you do not understand. Some key ones to know are:

BIOMARKER (BY-oh-MAR-ker):

Something that can be measured in your blood, tissue, or bodily fluid. In cancer, biomarkers are often used to help choose the best treatment for you.

your doctor match therapy drugs to the specific subtype of cancer you have. Your doctor may call this kind of testing biomarker testing, genomic testing, molecular profiling, tumor marker testing, mutation testing, or molecular testing.

GENE (jeen): Genes carry the information that passes on traits that can be inherited from parents to children. Chemically, a gene is made of DNA. Genes affect the way our cells and bodies work.

MUTATION (*myoo-TAY-shun*): A change in a gene.

What is Targeted Therapy?

Targeted therapy drugs keep cancer from growing and spreading with less harm to cells that are not cancer. They may have fewer side effects than other treatments because they are better able to attack your cancer cells and leave healthy cells alone. These drugs "target" specific cancer subtypes. They are only likely to work in those specific subtypes.

These drugs can work in several ways:

- They can find cancer cells.
- They can destroy cancer cells directly.
- Or they can cut off the blood supply that tumors need to grow and survive

IS TARGETED THERAPY RIGHT FOR YOU?

Today, targeted therapy is used to treat non-small cell lung cancer (NSCLC). So far, no targeted therapy is available for patients with small cell lung cancer (SCLC) outside a clinical trial, but research is ongoing. Your doctor will need to test your tumor for biomarkers to find out if targeted therapy is right for you. This is called biomarker testing. (See page 4 for more info on biomarkers and testing.)

This booklet is also available in Spanish!



HOW TARGETED THERAPY COMPARES

Some of the most common cancer treatments include:



TARGETED THERAPY

Targeted therapy drugs keep cancer from growing and spreading with less harm to cells that are not cancer. They may have fewer side effects than other treatments because they are better able to attack your cancer cells and leave healthy cells alone. These drugs "target" specific cancer subtypes. They are only likely to work in those specific subtypes. Diarrhea and skin problems, including rashes, are the most common side effects.



SURGERY

Surgery is an operation to remove the cancer (or part of it) from your body. It is not always possible or helpful. When it is thought that the cancer can be completely removed, it is often the first treatment. The most common side effects are pain, fatigue, bleeding, swelling around the surgical site, and infection.



CHEMOTHERAPY

Chemotherapy (also called chemo) uses drugs to attack and kill cancer cells. These very strong drugs attack fast-growing cells like cancer. Chemo can cause side effects like hair loss, nausea, mouth sores, and low white blood cell counts.



RADIATION THERAPY (RADIOTHERAPY)

Radiation therapy uses strong energy beams, such as very strong x-rays, electrons, or protons, to kill cancer cells and shrink tumors. Radiation can also damage normal tissue or organs, so it is carefully focused to reduce that damage. You may experience redness, burns, or hair loss in the area being treated. Other possible side effects include fatigue, loss of appetite, and nausea.



IMMUNOTHERAPY

Immunotherapy works by making the immune system stronger so it can fight cancer better. The immune system helps your body fight infections and other diseases, like cancer. But sometimes cancers learn how to avoid the immune system and grow anyway. Immunotherapy works to turn the immune system back on to fight the cancer. Common side effects include fatigue, skin problems, fever, and shortness of breath. Most side effects are mild, but some can be severe.

QUICK FACTS ABOUT BIOMARKER TESTING

- Biomarker testing helps your doctor match therapy drugs to the specific subtype of cancer you have.
- Your doctor may call this kind of testing biomarker testing, genomic testing, molecular profiling, tumor marker testing, mutation testing, or molecular testing.
- There are many different types of lung cancer, and each will respond better to certain treatments. Your doctor is trying to learn as much as possible about your lung cancer. This information will help your doctor find the best treatment for the specific subtype of cancer you have.
- Today, everyone with advanced non-small cell lung cancer (NSCLC) should get biomarker testing when they are diagnosed. They should get tested again when it grows, spreads, or returns. Ideally, you would get tested for biomarkers that can match your tumor to therapies available today, and to therapies in clinical trials.
- People with early-stage NSCLC should talk with their health care team about getting tested for EGFR before they start treatment.
- If you are not offered biomarker testing, be sure to ask for it.
- A sample is collected from your blood, bodily fluids, or tumor tissue taken during surgery or biopsy. This sample is sent to a lab to test for biomarkers to help guide your treatment options.
- Not every hospital can do biomarker testing onsite. If yours can't, your doctor can send your tissue out to a special lab.
- It is better to wait for all the results of biomarker testing before starting any lung cancer treatment. This ensures your first treatment is the best one for you.
- GO2 Foundation for Lung Cancer has a program called LungMATCH to help patients get biomarker testing. You can contact them at 800-298-2436 or by emailing support@go2foundation.org.

What are Biomarkers and Biomarker Testing?

A biomarker is something that can be measured in your blood, tissue, or bodily fluid. In cancer, biomarkers are often used to help choose the best treatment for you.

Several biomarkers are important to people with non-small cell lung cancer, and researchers are finding more each year. Pages 8-9 have a list of biomarkers and the targeted therapies that can be used in patients with those biomarkers. Research is ongoing in small cell lung cancer (SCLC) but, so far, there are no approved targeted therapies for SCLC patients available outside a clinical trial.

WHO SHOULD GET BIOMARKER TESTING?

All patients with advanced or recurrent non-small cell lung cancer (NSCLC) should ask their health care team to be tested for biomarkers. People with earlier stage non-small cell lung cancer should talk to their health care team about getting tested for the biomarker "EGFR" before they start treatment. Many people with earlier stage non-small cell lung cancer and any stage small cell lung cancer get biomarker testing to qualify for clinical trials. Be sure to ask your doctor whether there might be a clinical trial that is right for you.

WHEN SHOULD YOU BE TESTED?

You should get tested when you are first diagnosed with lung cancer. Biomarker testing should be done before starting treatment. Patients who test positive for certain biomarkers may not respond as well to standard chemotherapy or immunotherapy. For this reason, it can be better to wait a few weeks for the results of all biomarker tests, even if this means delaying start of therapy. Testing may also be useful when your

targeted therapy stops working, or when your cancer comes back.

WHAT TYPES OF TESTING ARE THERE?

Liquid "biopsy" is a biomarker test done through bloodwork. It tests tumor DNA or tumor cells found circulating in your blood. Your doctor may choose to do a liquid "biopsy," since it only needs a sample of blood. If a liquid "biopsy" comes back with a positive result, your doctor can use those results to choose treatment.

If test results are negative, your doctor may want to do a tissue biopsy. A tissue biopsy (testing a sample of the tumor) is the "gold standard" for biomarker testing. A tissue biopsy also gives your doctor more information about biomarkers.

For example, a tissue biopsy can tell your doctor if the cancer has the biomarker PD-L1. This biomarker is important because it can help your doctor understand if some immunotherapy drugs are a good treatment option for you.

WHERE DO YOU GET TESTED?

When possible, your tissue or liquid biopsy should be collected by a dedicated thoracic doctor at a center that does many such biopsies per week.

Not every hospital has a lab capable of testing for biomarkers. If this is not an option where you are receiving care, ask if your doctor can send your samples out for testing. If you are told that testing is not an option, you should consider getting a 2nd opinion, even if it is over phone or online, at a cancer center or hospital where these tests can be done. They can then work with your local doctor to help guide your treatment. Talking with a 2nd doctor can often help you better understand your cancer and how to treat it. A 2nd opinion can also make you feel more confident that you are making the right choices.

TAKING ORAL CANCER THERAPIES (PILLS) AT HOME

It's very important to take your pills as prescribed. Unless your doctor tells you to hold or reduce your pills due to side effects, missing a number of doses could make the cancer more likely to spread or return. Here are some tricks that may help you take drugs as prescribed:

- Set reminders on your phone or watch.
- Use a pill calendar or a pillbox to organize your pills by day and time. This will help you see if you have missed a dose.
- Sometimes drugs will come in a blister pack that helps you see whether you took your dose at the right time.
- Store pills in a place you will see them every day.
- Follow your doctor or pharmacist's instructions on what to do if a dose is missed.
- Tell your doctor about any missed doses at your regular appointments.
- Based on the drug ordered, your insurance company will tell you how you can get these drugs (such as through a specialty pharmacy, mail order, or a local pharmacy). If using a specialty or mail order pharmacy, you will need to allow extra time for delivery and set reminders to reorder your drugs in time.

WHAT SHOULD YOU BE TESTED FOR?

If you have NSCLC, ask to have your tumor tested for biomarkers, especially EGFR, ALK, BRAF, ROS1, RET, MET, NTRK, and PD-L1. This may be done using a multi-panel test that looks for all the biomarkers for which there currently are approved targeted therapies. A current list of biomarkers and the currently approved therapies that target those specific cancer subtypes is on pages 8-9. The test also looks for biomarkers for which targeted therapies are being tested in clinical trials. Other biomarkers that may be relevant to lung cancer include HER2, KRAS, and MEK1.

ONLINE PATIENT GROUPS THAT DISCUSS SPECIFIC TARGETS AND THEIR THERAPIES

To connect online with others who test positive for the same biomarkers as you, visit:

- EGFR Resisters www.egfrcancer.org
- ALK Positive www.alkpositive.org
- ROS1ders www.ros1cancer.com
- Exon 20 Group www.exon20group.org
- NTRKers www.ntrkers.org
- MET Crusaders www.metcrusaders.org

WHY IS BIOMARKER TESTING IMPORTANT?

Because they are designed to work against a certain target, most targeted therapies are only used when a biomarker test shows that they might be helpful. Patients that test positive for targeted therapy biomarkers may not respond as well to standard chemotherapy. PD-L1, on the other hand, is a biomarker for the use of immunotherapy. If your tumor is negative for the other biomarkers listed above and has high PD-L1, you are likely to have better results with an immunotherapy drug. But patients with biomarkers for targeted therapies should start out with targeted therapy, rather than immunotherapy. This is why it is very important to wait until ALL biomarker testing results have been returned, if possible, before starting treatment. Patients matched with their treatment based on biomarker testing may live a better and longer life.

Getting Targeted Therapy

HOW IS TARGETED THERAPY GIVEN?

Most often, targeted therapy is given in the form of a pill that you take at home once or twice a day. The pill may need to be taken at a certain time of day, with or without food or liquid. You need to remember to take the pill.

A few targeted drugs are given by IV (into a vein), sometimes in combination with chemotherapy. If this is the case, you may have to go into the hospital every 3 to 4 weeks for treatment. Be sure to ask how your treatment works. Let your health care team know of anything that could get in the way of you following the treatment plan.

TARGETED THERAPY FOR LUNG CANCER

Different types of targeted therapy are used to treat lung cancer. Most require a biomarker test,

but some do not yet have a good biomarker. Therapies that target the tumor's blood vessel growth (angiogenesis), known as VEGF inhibitors, currently do not yet have a good biomarker test and are most often given along with another treatment. See the charts for more information about VEGF inhibitors.

The key biomarkers that play a role in lung cancer: ALK, BRAF, EGFR, KRAS, MET, NTRK, RET, ROS1, and PD-L1. The chart on page 8 lists biomarkers, which drugs are approved to target them, and what percent of people with lung cancer have this biomarker. Other biomarkers that may be relevant to lung cancer include HER2 and MEK1. Drugs have not yet been approved to target them, but might be available through clinical trials.

Ask your doctor:

- If your tumor has been tested for these biomarkers.
- About targeted therapy options when you are diagnosed. Ask again in the future, in the likely case that more options become available.
- About the possibility of receiving treatment through a clinical trial.

New biomarkers continue to be discovered, and new drugs are being found that work against them.

RECEIVING TARGETED THERAPY THROUGH A CLINICAL TRIAL

Many patients with lung cancer decide to receive their treatment through a clinical trial.

Clinical trials are research studies to test new treatments or learn how to use existing treatments better. Every drug must be tested in clinical trials before it can be used with patients. Ask your doctor if a clinical trial might be right for you — before you start treatment or when you are looking at new treatment options.

Key things to know:

- People who receive their treatment through a clinical trial receive high quality care.
- There are rules about who can join each trial, so they are not available for every patient.
- Not all treatment centers offer clinical trials.
 And not all centers offer the same clinical trials.
- There are laws and review boards to protect the safety of people who participate.

- No one receives a placebo or "sugar pill" in place of appropriate treatment. You will always receive treatment that is at least "standard of care."
- If you join a clinical trial, you can leave at any time and for any reason.
- Often, the trial pays the costs of the drug being studied. Then, your health insurance and your copay cover "standard" treatment costs. Be sure to ask what costs you may incur.
- If you get your treatment through a clinical trial, you may need to visit your treatment center more often.

APPROVED TARGETED THERAPIES FOR LUNG CANCER BY BIOMARKER (as of June 2021)

New treatments become available all the time so this information may change. **This is the latest information on targeted therapies that is available as of June 2021.** For information on specific drugs and the latest approvals, go to **www.CancerSupportCommunity.org/Lung**.

TYPE OF THERAPY	DRUG NOTES (+ means a positive test)	
ALK INHIBITORS	 For ALK+ metastatic NSCLC Given as a once-daily or twice-daily pill 	
BRAF INHIBITORS	 For BRAF+ NSCLC Given as a once-daily or twice-daily pill Drugs are given in combination with each other 	

APPROVED TARGETED THERAPIES FOR LUNG CANCER BY BIOMARKER (as of June 2021)

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EGFR INHIBITORS	 For EGFR+ metastatic NSCLC Depending on the exact EGFR mutation, can be used as 1st treatment Can be used when other EGFR drugs have stopped working Given as a once-daily pill For EGFR+ earlier-stage NSCLC Depending on the exact EGFR mutation, can be used as treatment after surgery For advanced squamous cell NSCLC Given by IV (in the vein) in combination with chemotherapy
BISPECIFIC ANTIBODY	 For EGFR+ metastatic NSCLC Depending on the exact EGFR mutation, can be used as 1st treatment Given by IV (in the vein) every 2-4 weeks
KRAS INHIBITORS	For KRAS G12C+ metastatic NSCLCGiven as a once-daily pill
MET INHIBITORS	 For MET+ metastatic NSCLC Given as a once-daily or twice-daily pill
NTRK INHIBITORS	 For NTRK+ metastatic solid tumors, including NSCLC Given as a once-daily or twice-daily pill
RET INHIBITORS	 For metastatic NSCLC Given as a once-daily or twice-daily pill
ROS1 INHIBITORS	 For ROS1+ metastatic NSCLC Given as a once-daily or twice-daily pill
VEGF INHIBITORS	 For non-squamous advanced NSCLC For EGFR+ metastatic NSCLC Given in combination with another drug Given by IV (in the vein) every 3 weeks, often in combination with chemo

SIDE EFFECTS BY TYPE OF DRUG FOR LUNG CANCER

(as of June 2021)

Targeted therapies treat the cancer cells with less harm to normal cells. Not all people get all side effects. Be sure to tell your health care team about the side effects you have.

New treatments become available all the time so this information may change. **This is the latest information on targeted therapies that is available as of June 2021.** For information on specific drugs and the latest approvals, go to **www.CancerSupportCommunity.org/Lung**.

TYPE OF THERAPY	COMMON SIDE EFFECTS
ALK INHIBITORS	 Changes in vision (blurry vision) Diarrhea Nausea and vomiting Constipation Fatigue Loss of appetite Swelling Numbness Confusion and changes in mood
	 Rare but serious side effects may include: Problems to the heart, liver, kidneys, or lungs High cholesterol and triglycerides
BRAF INHIBITORS	 Fever Changes to skin (thickening, rash, warts, dryness) Fatigue Nausea and vomiting Diarrhea Sensitivity to the sun
	 Rare but serious side effects may include: Increased blood sugar Allergic reaction Problems to the heart, lung, kidneys, eyes, or liver
EGFR INHIBITORS	 Skin changes (acne-like rash, dry skin, itchiness) Diarrhea Loss of appetite Mouth sores Fatigue Nail infection
	Rare but serious side effects may include: Problems to the heart, lungs, liver, or eyes

SIDE EFFECTS BY TYPE OF DRUG FOR LUNG CANCER

(as of June 2021)

BISPECIFIC ANTIBODY

- Infusion reactions
- Rash
- Fatigue
- · Nausea and vomiting
- · Breathing problems
- · Nail changes
- Swelling
- Constipation

Rare but serious side effects may include:

- · Increased blood sugar
- · Problems to the heart, lungs, or liver

KRAS INHIBITORS

- Diarrhea
- Nausea
- Fatigue
- Cough

Rare but serious side effects may include:

Problems to the heart, liver, kidneys, central nervous system, or lungs

MET INHIBITORS

- Swelling
- Nausea
- Fatigue
- · Confusion and changes in mood

Rare but serious side effects may include:

· Problems to the liver and lungs

NTRK INHIBITORS

- Fatigue
- · Nausea and vomiting
- Constipation or diarrhea
- Dizziness
- Anemia
- Swelling
- · Change in taste
- · Abnormal touch sensation
- · Shortness of breath

Regular blood tests are needed to check liver function.

Rare but serious side effects may include:

· Problems with the liver, nervous system, heart, kidneys, or eyes

Let your doctor know if you have dizziness, unclear speech, problems walking, or are feeling tingling, burning or numbness. (Most often occurs in the first 3 months.)

SIDE EFFECTS BY TYPE OF DRUG FOR LUNG CANCER

(as of June 2021)

RET INHIBITORS

- Diarrhea
- Constipation
- Dry mouth
- Fatigue
- Swelling
- · High blood pressure
- · Heart rhythm changes

Rare but serious side effects may include:

· Liver, lung, and/or bleeding problems

ROS1 INHIBITORS

- · Changes in vision (blurry vision)
- Diarrhea
- · Nausea and vomiting
- Constipation
- Fatigue
- · Loss of appetite or change in taste
- Swelling
- Dizziness
- Abnormal touch sensation
- · Shortness of breath

Rare but serious side effects may include:

 Problems to the heart, liver, kidneys, eyes, central nervous system, or lungs

VEGF OR ANGIOGENESIS INHIBITORS

- · High blood pressure
- · Changes to skin (dryness, rash)
- Diarrhea
- Nosebleeds
- · Loss of appetite
- · Low blood counts
- Weakness
- · Upper respiratory infection
- Runny nose

Rare but serious side effects may include:

- · Bleeding problems
- Stroke
- Heart attack
- Blood clots
- · Wounds that may not heal
- · Tears in the stomach or bowel wall

MANAGING SIDE EFFECTS OF TARGETED THERAPY

Targeted therapies often have milder side effects than other cancer treatments. Skin rash is common but doesn't occur at all in some people. Ask about it before you start treatment so that you can have medicine for it available if needed. Rashes often get better with time. As with any cancer drug, remember these steps:

Before you start treatment: Ask about the side effects of any drug you consider and how tomanage them. Also ask about whom to contact if you experience serious side effects. There may be medicine you can take or use to prevent or ease symptoms.

During/after treatment: Report any side effects or changes to your health care team. Some side effects can get worse quickly if they are not treated.

FOR MORE INFORMATION ON MANAGING THE SIDE EFFECTS OF LUNG CANCER TREATMENT:

- See Chapter 5 of our Frankly Speaking About Cancer: Lung Cancer book, available at www.CancerSupportCommunity.org/Lung
- Visit www.CancerSupportCommunity.org/SideEffects
- Call our Helpline (888-793-9355) to mail order our *Lung Cancer* or *Coping with Side Effects* materials



QUESTIONS TO ASK YOUR HEALTH CARE TEAM

- What type of lung cancer do I have?
- If it is advanced non-small cell lung cancer, has my tumor biopsy been sent for biomarker testing for EGFR, ALK, BRAF, ROS1, NTRK, RET, MET, KRAS, and PD-L1?
- If so, what do the results mean for me?
- Is targeted therapy available for my lung cancer type? If so, what kind?
- Are there any clinical trials for targeted therapy that might be right for me? How do I find out more about them?

For each treatment that is recommended:

- What is the goal of this treatment? What are the risks?
- Is this treatment available in pill form? If yes, how often will I need to take pills?
 Do I take the pills with or without food?
- If this treatment is given by IV, where will I go to receive treatment and how long will each session take? Will I need someone to drive me home after treatment?
- Can/should I eat or drink before or after treatment? Is there any food or drink I should avoid while on this treatment?
- What side effects should I expect (short- and long-term)?
- What can I do to prepare for this treatment?
- How long will I need to be on this treatment?
- How will we know if this treatment is working?
- If it stops working, what is the next treatment option?
- How much will this treatment cost?
- Will I need other cancer treatments at the same time?
- How will this treatment affect my daily routine? Will I be able to do my usual daily activities?
- Whom should I call if I have questions or problems:

During office hours?	Name:	Phone Number:
After hours and weekends?	Name:	Phone Number:

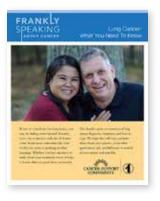


You can learn more about lung cancer, treatment, managing side effects, and how to cope in our comprehensive Frankly Speaking About Cancer: Lung Cancer book.



The companion booklet, *Treatments for Lung Cancer*, covers the chemotherapy, targeted therapy, and immunotherapy drugs currently approved to treat lung cancer.











To download or order our lung cancer materials, visit **www.CancerSupportCommunity.org/Lung** or call our Helpline at 888-793-9355.

Lung Cancer Information, Survivorship & Support

Cancer Support Community • 888-793-9355 • www.CancerSupportCommunity.org

American Cancer Society • 800-227-2345 • www.cancer.org

CancerCare • 800-813-4673 • www.cancercare.org

Cancer.net • 888-651-3038 • www.cancer.net

GO₂ Foundation for Lung Cancer • 800-298-2436 • www.go2foundation.org

LUNGevity Foundation • 321-407-6100 • www.LUNGevity.org

National Cancer Institute (NCI) • 800-422-6237 • www.cancer.gov

NCI Clinical Trial Information • 800-422-6237 • www.cancer.gov/ClinicalTrials

Patient Advocate Foundation • 800-532-5274 • www.patientadvocate.org

Cancer Support Community Resources

Cancer Support Helpline® — Have questions, concerns or looking for resources? Call CSC's toll-free Cancer Support Helpline (888-793-9355), available in 200 languages Mon - Fri 9am - 9pm ET.

Open to Options[®] — Preparing for your next appointment? Our trained specialists can help you create a list of questions to share with your doctor. Make an appointment by calling 888-793-9355 or by contacting your local ĈSC or Gilda's Club.

Frankly Speaking About Cancer® — Trusted information for cancer patients and their loved ones is available through publications, online, and in-person programs. Find more information on living with cancer, whether you are newly diagnosed, a survivor, or a loved one of someone who is living with cancer. www.CancerSupportCommunity.org/Living-Cancer.

Services at Local CSCs and Gilda's Clubs — With the help of 170 locations, CSC and Gilda's Club affiliates provide services free of charge to people touched by cancer. Attend support groups, educational sessions, wellness programs, and more at a location near you. www.CancerSupportCommunity.org/FindLocation.

Cancer Experience Registry® — Help others by sharing your cancer patient or cancer caregiver experience via survey at www.CancerExperienceRegistry.org.

MyLifeLine — CSC's private, online community allows patients and caregivers to easily connect with friends and family to receive social, emotional, and practical support throughout the cancer journey and beyond. Sign up at www.MyLifeLine.org.

Grassroots Network — Make sure your voice is heard by federal and state policy makers on issues affecting cancer patients and survivors by joining our Network at www.CancerSupportCommunity.org/become-advocate.

FRANKLY SPEAKING ABOUT CANCER: LUNG CANCER PROGRAM PARTNERS:









THIS PROGRAM WAS MADE POSSIBLE THROUGH GENEROUS SUPPORT FROM:











This book is available to download and print yourself at www.CancerSupportCommunity.org/Lung. For print copies of this booklet or other information about coping with cancer, visit Orders.CancerSupportCommunity.org.

The Cancer Support Community provides this information as a service. This publication is not intended to take the place of medical care or the advice of your doctor. We strongly suggest consulting your doctor or other health care professionals to answer questions and learn more.

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