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The Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins  
Department of Radiation Oncology and Molecular Radiation Sciences

# Your Guide to Radiation Therapy



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## Message from the Director



Caring for our patients is our top priority. Combining advanced technology with compassionate care is the hallmark of the **Johns Hopkins Department of Radiation Oncology and Molecular Radiation Sciences**. Innovations beyond standard technology set us apart from a routine experience. These innovations are the result of the unsurpassed level of expertise in radiation oncology, molecular radiation sciences, physics, surgical oncology, medical oncology, cancer biology, engineering, quantitative sciences and more that **Johns Hopkins Medicine** and the **Johns Hopkins Kimmel Cancer Center** bring to radiation therapy. This level of knowledge and multispecialty collaboration guides our patient care. It is a truly integrated effort, where we communicate about all aspects of the patient's clinical care and needs.

Radiation treatment is 100 years old and has drastically evolved with the invention of new technologies. We're giving patients very targeted treatments with improvements in machines, computers, training and clinical care, all combined with our research to provide precise, very direct radiation. We believe this level of excellence for cancer care is unparalleled. It makes our promise to every patient who walks through our doors possible—to do the important analyses, informed by a wide range of expertise, to correctly determine, patient by patient, which form of radiation therapy or combination of therapy is the optimal choice.


Sincerely,

**Akila Viswanathan, M.D., M.P.H.**  
**Director of Radiation Oncology and Molecular Radiation Sciences**

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# Welcome

Welcome to the Johns Hopkins Department of Radiation Oncology and Molecular Radiation Sciences, a world-renowned leader in radiation treatment. Our expert clinicians use cutting-edge technology to deliver the safest possible care and continue to expand evidence for new treatments through groundbreaking research. The team at Johns Hopkins includes over 30 radiation oncologists dedicated to patient-centered, specialized care at our clinics at The Johns Hopkins Hospital, Johns Hopkins Bayview Medical Center, the Kimmel Cancer Center at Green Spring Station, Howard County General Hospital, Suburban Hospital/Rockledge location and Sibley Memorial Hospital. Our physicians use their internationally recognized, disease-specific expertise to treat your specific type of cancer. Radiation oncologists work in inclusive, multidisciplinary teams—leading experts across all disciplines and specialties—and work cooperatively to provide the most advanced treatment options specific to each patient’s disease. We understand that every patient, every cancer is unique. We are focused on the most innovative tumor monitoring, advanced imaging and sophisticated data mining to ensure each patient receives the therapy that is best suited to the individual’s cancer. Our physicians will ensure that they use cutting-edge technology and consider you for innovative clinical trials depending on your needs. Our physicians lead international discoveries and pioneer technologic innovations. They use their knowledge and world-class expertise to personalize your treatment plan to give you the best possible outcomes.



**We understand  
that every  
patient, every  
cancer is unique.**

## **Our approach includes:**

Our team has subspecialized expertise to fight your cancer. Our teams are highly skilled and experienced physicians, physicists and other professional who work closely in a smooth and integrated fashion to ensure that your care is the most precise, personalized and highest quality it can be. We pride ourselves on our teamwork, close-knit services, compassion, professionalism and dedication, and will work together to design and treat you in the best possible fashion.

# Your Treatment Team



**Radiation oncologists:** Radiation oncologists are a type of doctor who specialize in giving radiation therapy to treat cancer. They oversee radiation therapy treatments and work closely with other team members to develop the treatment plan. Radiation oncologists prescribe and develop treatment plans that are specific to each patient, oversee the precise delivery of the treatment, and are committed to clinical care and development of new patient clinical trials.

**Radiation oncology nurses:** Radiation oncology nurses care for patients during the course of treatment. Along with the oncologist, nurses are the key links to the patients and their families, talking with them before and during treatment to ensure the patient's comfort, monitoring the patient's condition, and managing any side effects. They provide information, reassurance and assistance to each patient they care for. Each radiation oncology nurse at Johns Hopkins specializes in specific tumors and cancers, just as our radiation oncologists are subspecialized in specific tumors. This specialization also means that they can devote more time to the patients they care for and their families.

**Radiation therapists:** Radiation therapists administer the daily radiation treatment under the doctor's prescription and supervision. Radiation therapists at Johns Hopkins are subspecialized, meaning they work with certain kinds of treatments, providing a depth of experience and expertise that is unmatched. Radiation therapists complete a two- to four-year program after high school or college. They must take an examination to be certified by the American Registry of Radiologic Technologists.

**Medical physicists:** Medical physicists oversee the entire flow in the radiation oncology clinic. They work with physicians and dosimetrists to develop customized treatment plans for each patient, and with radiation therapists to ensure the safety and accuracy of each patient's daily treatments. The medical physics team is responsible for the development and management of the Quality Management Program that governs quality control of the equipment, imaging and treatment delivery. They also work with the clinical team to evaluate new equipment, procedures and clinical trials to ensure that the most up-to-date treatments are available for our patients. Additionally, our medical physics faculty members lead innovative research in imaging, informatics and technology development, all focusing on the development of new translational techniques to improve personalized radiation therapy plans provided to each patient.

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**Dosimetrists:** Dosimetrists carefully calculate the dose of radiation and develop the treatment plan to make sure the tumor gets the correct radiation as prescribed by the radiation oncologist. They work with the doctor and medical physicist to choose the treatment plan that is just right for each patient. Dosimetrists take a certification examination administered by the Medical Dosimetrist Certification Board. Many dosimetrists began as radiation therapists and complete intense medical dosimetrist training. Others receive bachelor's degrees followed by training.

**Research faculty members:** Research faculty members develop studies to examine how radiation and medical physics can be made even more effective and better targeted to treat the cancer while leaving healthy tissue and organs unaffected.

See a full list of our [team members](#), including their tumor specialties.

Our Johns Hopkins team offers advanced and individualized treatment for every patient, irrespective of age. Our physicians are international experts in the types of highly specialized treatments required for your care. We also support your needs and create a compassionate environment, recognizing that your specific needs are unique. We support cancer treatments of all types and focus in disease sites, including:

[Blood and Bone Marrow Cancers](#)

[Breast Cancer](#)

[Melanoma and Other Skin Cancers](#)

[Colorectal Cancer](#)

[Pancreatic Cancer](#)

[Liver Cancer](#)

[Bladder Cancer](#)

[Gynecologic Cancer](#)

[Head and Neck Cancer](#)

[Brain Tumors](#)

[Sarcoma](#)

[Lung Cancer](#)

[Esophageal Cancer](#)

- **Patient safety:** Our patient safety program, cited as one of the best in the nation, employs high-quality assurance protocols and innovative techniques to ensure the safety and well-being of all patients. Our team takes extra care to treat cancer cells while sparing neighboring healthy tissues. Multiple safety checks are built into every step of care to ensure treatment plans are accurate and effective. A dedicated safety committee actively reviews and studies all clinical processes. In addition, teams integrate safety techniques developed at Johns Hopkins, such as checklists and case reviews.
- **Cutting-edge MR and CT imaging techniques** allow precise identification of all sites of disease.
- **Individualized plans:** Each patient who comes to Johns Hopkins can expect an individualized treatment plan and comprehensive consultations that answer every question.
- **Clinical trials:** These are offered to patients to provide them with unique access to specialized care. Through these trials, our team continuously develops and improves upon radiation oncology approaches to cancer treatment.



**We support  
cancer  
treatments  
of all types.**

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- **Multidisciplinary clinics:** Radiation oncologists are pleased to work side by side with other clinical specialists in medical and surgical oncology, pathology, and interventional radiology in a number of multidisciplinary cancer clinics for those with breast, head and neck, lung, pancreas, prostate and other cancers.
- **Research:** Researchers in radiation oncology develop studies to examine how radiation and medical physics can be made even more effective and better targeted to treat cancers.
- **Proton therapy:** The new Johns Hopkins Proton Therapy Center at Sibley Memorial Hospital is built upon a long and rich tradition of excellence in radiation oncology, bringing nearly a half-century of cancer discover and clinical progress to proton therapy. Our new center enhances our mission of curing cancer and changing lives.

# What Is Radiation Therapy?



Radiation therapy is a very important component of cancer treatment. Radiation therapy uses **energy, such as high-energy X-rays or charged particles, to damage the DNA of cancer cells** so they stop dividing and die. The goal is to kill cancer cells while sparing healthy cells as much as possible.

Radiation therapy does not hurt. Some people develop sunburnlike symptoms or other side effects, which will be explained later in this booklet, but the treatment does not cause pain.

Radiation therapy may be **the only therapy** you need for treating your cancer. In other cases, you may get **radiation therapy before or after surgery, chemotherapy or immunotherapy**. Radiation therapy can weaken cancer cells and make them more sensitive to chemotherapy or immunotherapy. Your doctors may recommend radiation therapy to kill cancer cells left behind after surgery.

## Types of Radiation Therapy

**Radiation therapy can be external or internal.** In external radiation therapy, the energy aimed at the cancer comes from a source outside the body. In internal radiation therapy, the energy comes from a small radiation source that is placed inside the body.

### External Radiation Therapy at Johns Hopkins

**External beam radiation:** External beam radiation therapy delivers a beam of high-energy X-rays to your tumor using a machine called a linear accelerator. Your doctors may use frequent imaging scans or 3D models of the tumor site as a guide for directing the X-ray beam. They may also use multiple beams to target a tumor from different angles. These details help direct all the energy to the tumor and minimize harm to nearby healthy tissues. **Image-guided radiotherapy, intensity-modulated radiation therapy, 3D conformal radiation therapy, tomotherapy and volumetric modulated arc therapy** are all types of external beam radiation.

**The goal is to kill cancer cells while sparing healthy cells**

**Stereotactic radiosurgery:** Stereotactic radiotherapy delivers multiple beams of radiation from different angles and planes, using 3D imaging to locate the tumor and guide the beams. It may be used instead of invasive surgery for tumors located in hard-to-reach places, like the brain, or for very small tumors. For this reason, patients are kept immobile during the procedure. Stereotactic radiosurgery may involve one treatment or be spread out in multiple treatments over several days using lower doses of radiation. CyberKnife, which uses a robotic arm to deliver the radiation, is one type of stereotactic radiosurgery.

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**Stereotactic ablative radiotherapy:** Stereotactic ablative radiotherapy is very focused radiation that reduces exposures to surrounding tissue and organs. It also makes it possible to deliver higher doses of radiation to tumors over a relatively short period of time: five days versus six weeks with external beam radiation therapy. Precise, high doses of radiation using beams of different intensities are delivered at different angles. This requires guided imaging and patient immobilization. Stereotactic ablative radiotherapy is sometimes used in combination with chemotherapy and/or immunotherapy to convert inoperable cancers to operable cancers.

**Proton therapy:** Proton therapy is also called heavy ion therapy. It uses high-energy particles called protons instead of X-rays to kill cancer cells. The proton beam zeros in on and stops inside the tumor, where it deposits most of its energy. Because it is so precise, proton therapy may be used to treat cancers near delicate organs, like the spinal cord and heart, or hard-to-reach tumors in the brain, eye or base of the skull and neck. Our Johns Hopkins Proton Therapy Center is one of the largest and most advanced facilities in the world, with CT imaging integrated for the most accurate and precise treatment delivery of proton beam therapy. Respiratory gating technology tracks the proton beam to the movement of the tumor to ensure that the beam stays locked on to the tumor and is not impacted by movement associated with breathing. In addition, its pencil beam delivery precisely keeps the proton beam energy within the confines of the tumor.

#### **Internal Radiation Therapy at Johns Hopkins**

**Brachytherapy (low-dose rate and high-dose rate):** Brachytherapy is a targeted radiation treatment that uses a special needle or catheter to deliver radioactive “seeds” or another radiation source of focused radiation to a tumor. The seeds or radiation source may be inserted just for several minutes or hours and then removed with high-dose rate, as is used often for gynecologic cancers, or left inside the body to release radiation over time with low-dose-rate radiation, as is often used for prostate cancer. At Johns Hopkins, we use brachytherapy to treat prostate, gynecological, head and neck, and other cancers. Uveal melanoma is treated with eye plaque brachytherapy. Brachytherapy can be used as an alternative to surgery to spare organs or in addition to surgery to help decrease the chance of a cancer coming back. Our experts continue to advance this treatment with MRI- and CT-assisted approaches, and provide cutting-edge approaches to treatment using real-time MR-guided brachytherapy for the treatment of gynecologic cancers.

**Intraoperative radiation therapy** provides an intensive, targeted dose of radiation to a tumor site during surgery, after the tumor is removed, to sterilize the area where the tumor was located. It is often given after standard radiation therapy and has been shown to decrease the chance of the cancer coming back. This therapy is particularly effective at treating recurrent tumors and large tumors that adhere to normal tissues. It may cause fewer side effects than traditional external beam radiation treatment.

**Radio embolization:** Radio embolization uses tiny glass or resin beads called microspheres to deliver radiation to a tumor through the bloodstream. These particles are placed inside blood

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vessels, where they travel to the tumor and deliver a high dose of radiation. TheraSphere is one type of radio embolization used at Johns Hopkins to treat liver cancers.

**Active Breathing Coordinator (ABC)**

ABC is an interactive device that coordinates breathing during treatment because tumors can shift up and down as a person breathes. This tool, invented by a Johns Hopkins Kimmel Cancer Center physicist, locks the breath in place for a short, comfortable period to deliver radiation during the optimal times of the breathing cycle.

# Safety and Quality Assurance



Our patient safety program—cited as one of the best in the nation—employs quality assurance protocols and innovative techniques to ensure the safety and well-being of all of our patients. In addition to employing the equipment and treatment quality assurance protocols required by industry and the state of Maryland, we also integrate innovative safety techniques developed at Johns Hopkins, such as checklists, time-out procedures and case reviews.

A dedicated safety committee actively reviews and studies our clinical processes to ensure that our patients receive the safest and most efficient treatment plans. The committee's findings are then used to educate staff and implement improvements.

Our team has access to the latest findings and best practices, which we include in these quality control steps:

- Review of every treatment plan by radiation treatment team members
- Rigorous double-checks of every plan prior to the start of treatment by the radiation oncologist, a qualified medical physicist and a certified radiation therapy technologist
- Independent verification of the delivered dose in each plan
- Regular X-ray or CT imaging to verify the location of the radiation beams
- Time-out verification steps: Before radiation is turned on, the radiation therapist double-checks that the written treatment plan and doses match the radiation delivery machines.

Our researchers study the use of task/step checklists to ensure that treatment plans and safety measures are followed. They also examine which safety measures are most effective, constantly improving our safety practices.

# Treatment Approach

## Step 1: Consultation

Your first visit with your radiation oncology team is a **consultation appointment** to learn more about you and your specific cancer. Plan for your consultation appointment to take one to two hours.

During the consultation, the team will:

- **Review your health history** with you in detail, using any X-rays, scans, laboratory test results and other information from your referring physician and other health care providers.
- **Perform a physical examination**, taking into account important vital signs—temperature, blood pressure and heart rate—and evaluating your body using observation and hands-on techniques, such as palpation and listening to your heart, lungs and other organs.
- **Review your allergies and current medications**, including any supplements, vitamins or over-the-counter medications that you take.
- **Present their treatment recommendations** to you, including why you may or may not need radiation treatment and the likely results of treatment.
- **Answer your questions** about the recommended treatment.

If you are **pregnant or think you might be pregnant**, you must tell your radiation team before starting treatment. Radiation therapy can injure a developing baby. Radiation treatment can also affect your fertility. You can talk to your team about options to **protect and preserve your fertility** if you plan to have children in the future.

Here are a **few common** questions you may ask at your consultation or at any point during your treatment:

- Why is this type of radiation therapy being recommended?
- How soon should my treatment start?
- Where will I receive my treatments?
- What should I do to prepare for my treatments?
- How long does each treatment take, and how long does the whole course of radiation therapy take?



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- What kinds of side effects can I expect from this treatment?
- Will my normal activities be limited before and after my treatment?
- Can a relative or friend come to my treatments with me?

Your nurse can provide further education and schedule your next appointment if needed. You will also receive a packet of information about your treatment, including contact information for your team.

### **Step 2: Simulation: Mapping the Area to Receive Radiation**

Before starting radiation, you will be scheduled for a **simulation appointment** to plan your treatment. During this session, which may take about one hour, your radiation oncologist and other members of your team will create a detailed 3D picture of the area of your body to be treated.

The simulation can include CT scans and, for many patients, an MRI simulation scan to map out the exact location of your tumor. The treatment team may then test different positions for your body during the treatment to ensure that you are in the most effective and safest position to receive radiation. The team may also use molds, headrests or other devices designed specially to hold your body in the right position. Team members may also make special shields to help focus the radiation and protect surrounding tissue. Sometimes the team will mark the skin on the area of the body to be treated using a marker or a tiny tattoo.

Your radiation treatment will typically begin two weeks after your simulation session so your radiation oncologist, physicists and dosimetrists can take the time needed to develop your intricate treatment plan.

### **Step 3: Your Radiation Treatment**

The timing of radiation therapy is tailored to the specific needs of each patient. When it is given in combination with surgery, radiation treatment usually starts after surgery. Sometimes radiation therapy may be given before surgery to decrease the size of a tumor. It is often given in combination with chemotherapy and other drug therapies, such as targeted therapies or immunotherapy. The timing of each of these treatments will be managed by your multispecialty care team. Radiation therapy can also be given to manage pain caused by tumors.

Each radiation treatment takes **approximately 10 to 30 minutes** and is delivered **daily for three to six weeks**, depending on your treatment plan. You will not be treated on weekends and holidays.

You will see your radiation oncologist **once a week** to monitor how well you are tolerating your treatments and to ask any questions you may have. A radiation oncologist and nurse are always available to you if you need to be seen on any other day. You will be given an **urgent after-hours phone number** to call should you have any needs outside of clinic hours.




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## **At Your Appointment**

Please arrive 30 minutes before your scheduled appointment time. When you arrive, a member of your team will explain the check-in process and where to place your personal items during the treatment. Depending on the area of your body being treated, you may be asked to change into a hospital gown.

Family members or friends who accompany you for your visit will be asked to wait in our waiting room. (Please see current visitor guidelines and restrictions due to the COVID-19 pandemic.)

Before the treatment starts, your team will review the radiation instruments and your records to place you in the correct position. When the treatment begins, team members will be located in a special area just outside of the treatment room and will be able to see you and communicate with you the entire time.



**Please arrive  
30 minutes  
before your  
appointment  
time.**

## **How Will It Feel?**

Radiation therapy does not sting, burn or hurt when it is delivered. If you are receiving internal radiation therapy, you may receive an anesthetic to numb the area where the radiation source is placed into the body using a catheter or small needles. If you feel any discomfort during the procedure, please let your team members know right away.

## **What Happens After the Treatment?**

You may see your radiation oncologist after certain treatments. Your therapist or nurse will advise you if you can leave after treatment or should remain for a visit with your doctor.

You will not release radiation from your body after an external radiation treatment, so it is fine for your family and friends to hug and touch you after treatment. If you received an internal radiation treatment, there may be some restrictions on when others can touch you or be near you, until the internal source of radiation is removed from your body.

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# Managing Side Effects

Radiation therapy can cause short-term side effects that appear after your treatment and last for a few weeks. The **most common short-term side effects** of any radiation treatment include fatigue, loss of appetite or nausea, and sunburnlike skin irritation.

Side effects vary depending on the kind of radiation treatment and the kind of cancer that is being treated. For instance, radiation for a tumor in the neck can cause dry mouth as a side effect, radiation therapy for a brain tumor can cause hair loss and radiation for a pelvic tumor may cause urination difficulties. Your nurse will talk to you about which side effects to expect with your treatment and cancer. Our physicists developed a special computerized system called Oncospace that is aimed at decreasing side effects of radiation therapy.

**Longer-term side effects** can develop over months or years after your treatment. Your team will keep a close eye on all side effects that you might experience and recommend any additional treatment for them.

The Kimmel Cancer Center has a list of [common side effects for cancer treatment](#) and ways to manage them.



**Your team will  
help you manage  
any side effects.**



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# Our Support Services

We provide a broad base of support and resources for patients, families and caregivers, including mental, social and spiritual health support through the [Harry J. Duffey Family Patient and Family Services Program](#).

Our Patient and Family Services [team members](#) are master's-level social workers with expertise in the specialized field of oncology. They can teach you how to manage the stress and changes that may come with cancer.

Our **support and resource programs** include:

- Accommodations and housing information during treatment
- [Oncology social workers](#) for patients and families
- [Living With Cancer Resource Program](#) support groups
- Discharge planning
- [Patient Education Resource Rooms](#)
- [Johns Hopkins Home Care Group](#)
- Interpreters
- Fitness and nutrition consultations
- Insurance and financial assistance
- Pain and palliative care experts
- Spiritual and pastoral care
- Survivorship programs
- Transportation accommodations
- [Image Recovery Center](#) for wigs, prosthetics and skincare
- [Video Center](#) for educational videos on cancer treatment for patients and caregivers

For more information and contact information for our full range of patient and caregiver resources, visit the [Patient Information](#) page of our services program.

[Patient Guide](#) for Harry and Jeanette Weinberg Building visits

[Patient Guide](#) for Skip Viragh Outpatient Cancer Building visits



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# Commonly Used Terms

**3D conformal radiation therapy:** an external radiation therapy that uses imaging scans to create a 3D model of a tumor's exact size and shape

**Active Breathing Coordinator (ABC):** advanced technology that allows radiation treatment to be given only during the most favorable phase of the breathing cycle

**Brachytherapy:** an internal radiation therapy that uses targeted, high-dose radiation treatment delivered via radioactive “seeds” that are placed directly in or near the tumor

**chemotherapy:** the use of special medicines to treat cancer

**CT scan:** also called a CAT scan or computed tomography scan; a type of imaging in which a machine rotates around the patient and creates a picture of the inside of the body from different angles and at greater detail than a normal X-ray

**CyberKnife:** a type of stereotactic body radiation therapy that uses a robotic arm to deliver radiation

**endocrine therapy:** also called hormone therapy; a medical treatment that adds, blocks or removes hormones to slow or stop the growth of cancer

**internal radiation therapy:** treatment where the radiation aimed at a tumor comes from a small radiation source that is placed inside the body

**linear accelerator:** machine that delivers radiation to a tumor during external radiation therapy

**medical oncologist:** member of your health care team who treats cancer using chemotherapy or other medications, such as immunotherapy

**medical physicist:** member of the radiation oncology team who develops and monitors quality control plans for radiation equipment and procedures

**oncology:** the diagnosis and treatment of cancer

**palliative care:** a special type of care that concentrates on easing the pain and discomfort of a disease rather than providing treatment

**proton therapy:** an external radiation therapy that uses targeted energy from positively charged particles called protons

**radio embolism:** an internal radiation therapy that uses tiny glass or resin beads called microspheres to deliver radiation to a tumor after traveling through the bloodstream

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**radiation oncologist:** a member of the radiation oncology team who prescribes and develops treatment plans that are specific to each patient and oversees the precise delivery of the treatment

**radiation oncology nurse:** a nurse specially trained in the treatment of people receiving radiation for tumors

**stereotactic body radiation therapy:** an external radiation therapy that delivers very high doses of radiation using several beams of different intensities and aimed at different angles to target the tumor

**stereotactic radiotherapy:** an external radiation therapy that delivers multiple radiation beams from different angles and planes

**tomotherapy:** an external radiation therapy that combines intensity-modulated radiation therapy with CT scans

**volumetric modulated arc therapy:** an external radiation therapy where single or multiple radiation beams sweep around the patient, greatly reducing treatment time



# Contact Us

Please call us at **410-502-8000 M-F 8 AM to 5PM to request an appointment.**

**Visit the Johns Hopkins Department of Radiation Oncology and Molecular Radiation Sciences [website](#).**

**[Contact information](#)** for the members of your radiation oncology team is included in the packet of information you will receive at your consultation appointment.

We have **[six locations](#)** throughout the Baltimore-Washington area region, making it easy to get the care you need.



**JOHNS HOPKINS**  
M E D I C I N E

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THE SIDNEY KIMMEL  
COMPREHENSIVE CANCER  
CENTER