Ushering in a New Era of Cancer Medicine. Recent advances in our understanding of radiation biology, molecular biology, and imaging are allowing our scientists to see and study tumors like never before. We can now develop unique treatment strategies for patients in ways only dreamed of by previous generations of physicians, scientists and patients. The possibilities for increasing cancer cure while at the same time minimizing the side effects of treatment are real.
Our interdisciplinary team of clinicians and scientists continue to provide hope to cancer patients by improving cancer detection, diagnosis, treatment and prevention, both at Johns Hopkins and across the globe.

Through discovery, translation, and application, our experts are transcending the boundaries of the laboratory and moving research discoveries to the clinic with personalized and targeted radiation therapies for cancer patients. We are ushering in a new era in cancer medicine.

ABOUT RADIATION ONCOLOGY
The Department of Radiation Oncology and Molecular Radiation Sciences received individual departmental status in 2003. However, laboratory and clinical research programs in radiation oncology have a long and esteemed history at Johns Hopkins, first established in 1973 at the opening of the National Cancer Institute-designated cancer center, and it remains today an integral part of the Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins.

Radiation oncology specializes in the treatment of cancers through radiation therapy, utilizing state-of-the-art technology and contemporary biologic underpinnings to design and deliver novel cancer treatment. With more than 30,000 square feet of dedicated space, the department’s mission is to accelerate laboratory and clinical research of novel cancer treatments.

PERSONALIZED RADIATION THERAPY THE NEW GENERATION OF RADIATION TREATMENT

DATA MINING THAT IMPROVES PATIENT CARE
Johns Hopkins Radiation Oncology and Molecular Radiation Sciences physicists created a data-mining system called "Oncospace" that stores data on all previous patients and uses advanced computer technology to cull this information and apply it to improve the treatment of new patients. It represents one of the first demonstrations of how large data warehouses of patient information collected from previously treated patients can be used to make individualized treatment decisions for new patients. The system uses anatomy, radiation dose distributions, toxicity, and outcome data of prior patients to improve the therapy for those about to be treated. It enables the analysis of the best outcomes, and conversely, those with less than favorable outcomes, to create the optimal treatment plan. Oncospace was piloted in head and neck cancer and considerably improved treatment plan quality and reduced radiation to surrounding organs and structures. Studies in pancreas, prostate, and other cancers are now planned.

More recently, the team successfully tested Oncospace at two other institutions. Each cancer center maintained its own data, but was able to query Oncospace and receive a treatment plan. This work has set Johns Hopkins apart from others in the field and has been lauded by the American Society of Radiation Oncology (ASTRO) and the American Society of Clinical Oncology (ASCO). With continued support, this novel system could be expanded to include data from hundreds of institutions.

The Johns Hopkins Department of Radiation Oncology and Molecular Radiation Sciences is committed to playing a key role in the success of the campaign. Please join with us in this important mission.

A CALL TO ACTION
Rising to the Challenge: The Campaign for Johns Hopkins will raise unprecedented levels of support to attract, sustain, and further empower the people of Johns Hopkins—our students, faculty, and researchers—who through their work improve the lives of millions around the world. Together with our philanthropic partners we will:

ADVANCE DISCOVERY AND CREATIVITY through support of our exceptional faculty and researchers. Their innovative work drives the development of new knowledge, new forms of expression, and new ways to save lives and improve health, and furthers progress across our core disciplines in science and technology, the humanities and arts, and public health and medicine.

ENRICH THE STUDENT EXPERIENCE by investing in scholarships and fellowships, inspirational spaces for collaborative learning and social opportunities, and new programs that will enhance student-faculty interactions, ensure diversity on campus, link learning in the classroom to life after graduation, and strengthen connections between our students and our surrounding communities.

SOLVE GLOBAL PROBLEMS AS ONE UNIVERSITY by creating new cross-disciplinary solutions in crucial areas such as sustaining global water resources, revitalizing America’s cities, advancing individualized and population health, and understanding how we learn and teach.

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TARGETED RADIATION THERAPY

PROTON THERAPY

Proton therapy is targeted radiation therapy. It very precisely zeroes in on tumors, increasing the damage to cancer cells, while minimizing radiation exposure to healthy tissue and organs. It is the state-of-the-art in radiation treatment for several types of cancer. With its precision and safety, it has become the standard of care for pediatric tumors, tumors of the brain, spine and eye, lung, head and neck, and bone (sarcoma) cancers.

Our clinical and research teams are world leaders in radiation oncology technology development, radiation quality and safety, and it is one of the few medical institutions with a pediatric radiation oncology expert. Johns Hopkins has become synonymous with excellence in patient care, and so it is critically important that we acquire this technology.

Proton therapy is not a new radiation oncology tool, but it has now become essential to providing cutting edge cancer care. Of the top-ranked cancer centers nationally, Johns Hopkins is the only one that does not currently treat patients with proton therapy. Many experts question whether our institution can remain a leader in cancer medicine without acquiring proton beam therapy.

Johns Hopkins Radiation Oncology investigators would conduct clinical research to provide some of the first evidence-based approaches to proton therapy. Our scientists will have the opportunity to become the global leaders in the study of cellular response to proton therapy. Because proton therapy is so well targeted, many have theorized, fewer high dose treatments of proton therapy may be more effective than longer, lower dose conventional therapies. Our researchers would be among the first to test this as well as begin to explore the benefits of combined therapies with radiosensitizers and chemotherapy. In addition, our team could use basic and clinical research to resolve the scientific controversy surrounding the benefits or proton therapy in treating prostate cancer.

Johns Hopkins would locate its proton therapy facility at our Washington D.C. campus where there is ample space to construct the facility necessary to house the equipment and staff. An investment in proton therapy would mark the first signature investment in the advancement of cancer care in the National Capital Region, and it would be the foundation of the D.C. campus of the Kimmel Cancer Center providing opportunities to grow cancer diagnostic, treatment, and research services and collaborations with the National Cancer Institute, Children’s National Medical Center and other critical D.C. partners.

RADIATION SENSITIZERS

Radiation kills cells by damaging the DNA inside the cell. The great challenge in the radiation treatment of cancer is effectively killing cancer cells without causing harm to surrounding healthy tissue and organs. Radiation Oncology investigators have developed a technology that now makes this possible. Targeted radiation sensitizers are specific to cancer cells and prevent them, and only them, from repairing radiation damage. As a result, clinicians could deliver the same cancer-killing effect using much lower doses of radiation or, conversely, maintain the dosage and obtain a far greater destruction of cancer cells.

The breakthrough focuses on small inhibitory RNA (siRNA) molecules that have the ability to interfere with the expression of genes. The researchers use aptamers, a guidance system of sorts, to get the RNA molecule to its target inside of cancer cells where it shuts down cancer cells’ ability to make repairs, and as a result, they die.

The Radiation Oncology team at Johns Hopkins team was the first to show that small inhibitory RNA could be used for cancer therapy. The aptamers, which allow the repair-blocking inhibitory molecules to be targeted specifically to cancer cells, are unique.
to Johns Hopkins and considered the medical standard. Moreover, it is a platform technology that can be used in any cancer type, simply by changing the aptamer.

The investigators have successfully tested the technology in laboratory studies and animal models. To move to the next step and make this innovation available to patients suffering from all types of cancers, the team is now working to develop a clinical-grade (FDA-approved) siRNA and aptamers.

**NATURALLY TARGETED NANO Particles**

Nanoparticles are ultra tiny structures. As small as they are, however, they are much bigger than small molecules—agents commonly used to treat cancer. In fact, hundreds of thousands of small molecules could fit inside one nanoparticle. As a result, they can be loaded up like a Trojan horse and sent out to deliver their cargo to cancer cells. But when working in the science of the small—invisible to the human eye—it is difficult to know if an agent is hitting its cancer target, and furthermore, if it is having the intended effect against the cancer.

Now, a multidisciplinary team of experts, led by scientists in Radiation Oncology, has developed a combined imaging/treatment approach at the molecular level that allows researchers and clinicians to see inside the cancer cell and view them as they are being treated. The team has developed a first-of-its-kind approach for prostate cancer that uses nanoparticles filled with an anticancer drug that also sensitizes cancer cells to radiation and a radiopharmaceutical or cell-imaging agent. The nanoparticle is targeted to PMSA, a biomarker for prostate cancer, so that it zeroes in on and delivers its anticancer payload specifically to prostate tumors and also allows investigators to track and monitor the drug’s journey and affect against its cancer target. All of the agents have been used separately in patients before and deemed safe. The only remaining hurdle to move this promising method to patients is funding.

When prostate cancer spreads, it is usually to the bone, so investigators are building upon this nanotechnology approach using alpha particles, a type of radionuclide that is naturally targeted to the bone. It captures the killing power of decaying radium, but in this form it has a short life of about ten days and only causes damage in the limited path it travels in the body. Radium has a chemical relationship to calcium, and so acts in the human body like calcium, naturally traveling to the bone—the site of prostate cancer metastasis.

Investigators are studying a combined nanoparticle/alpha particle/radiation treatment. The nanoparticle, loaded with its radiation-sensitizing anticancer drug, is given simultaneously with the bone-metastasis-targeting alpha particle to exquisitely and precisely attack prostate cancer and its spread.

**LABORATORY ACCELERATOR PROGRAM**

Identifying drugs that sensitize cancer cells to radiation is very difficult and complex because drugs must sensitize cancer cells without sensitizing the many more normal cells. The difficulty is in finding drugs that distinguish normal cells from cancer cells.

With expertise in drug screening, pharmacology, radiology, and radiation biology, Johns Hopkins Radiation Oncology is among the very few places that have the combined expertise required to perform comprehensive drug screening of radiosensitizers.

The Laboratory Accelerator Program would provide a dedicated and centralized resource for investigators performing this research critical to personalized cancer medicine and delivery of targeted radiation therapy.

**FACULTY SUPPORT AND RESEARCH TRAINING PROGRAM**

Like other Johns Hopkins departments, Radiation Oncology attracts the best and brightest young minds in medicine. Professorships, fellowships, and scholarships provide resources for faculty and young trainees, allowing us to attract, train, and retain the best and brightest in the field.

Among our current class of fellows are two Rhodes Scholars. The Radiation Oncology fellowship program has four years of funding, but fellows have five years of training. Four years are spent in clinical work and the fifth is centered on research. Additional support is critical if we are to maintain this level of excellence.

**WHY JOHNS HOPKINS? WHY NOW?**

Radiation Oncology is particularly dependent upon technology to provide the best and safest care, and philanthropic support ensures that our laboratories and clinics are outfitted with state-of-the-art equipment and devices so that we may better explore and deliver radiation therapy. Our team of experts is leading the way, inventing new systems and technologies that are revolutionizing the nature and delivery of radiation treatment. This pursuit of excellence has resulted in new discoveries that are transforming cancer care. We are poised to advance the effectiveness of radiation delivery at this critical time in history. Working with our colleagues in the Kimmel Cancer Center, we are uniquely positioned to make revolutionary advances against cancer.