Memorial Sloan Kettering Cancer Center | GIVING

YEAR IN REVIEW 2021

In 2021, MSK physicians, nurses, scientists, and educators continued to accelerate the pace of innovation, developing new cancer treatments and transforming the way the world understands cancer. Your philanthropy fuels our progress. Thank you for supporting our mission and for all you do for people with cancer.

Today we see a clear path forward to dramatically improve the outcomes for people diagnosed with or at risk of cancer. The support of our donors ensures that MSK's future will be even more remarkable than our past.

Craig B. Thompson, MD
President and Chief Executive Officer
Douglas A. Warner III Chair

FDA APPROVALS EXPAND TREATMENT OPTIONS

FDA approval of a drug or technology can take many years of research, beginning in the laboratory and ending in clinical trials that demonstrate its safety and effectiveness. MSK continues to be a world leader in approvals of cancer diagnostics and therapeutics, ensuring that these advances are available to people who need them. In 2021, the FDA approved or recognized the following therapies and precision oncology tools:

- Prostate cancer is notoriously difficult to detect once it spreads, but this is changing with the approval of piflufolastat F 18 (Pylarify®), a radioactive tracer that binds to a protein on the surface of prostate cancer cells, making them visible on PET scans. Radiologists Hebert Alberto Vargas and Jeremy Durack were key collaborators in the development and testing of the tracer, and medical oncologist Michael Morris helped lead clinical trials pivotal to its FDA approval. This is the first radioactive tracer for prostate cancer detection authorized for nationwide use, and will significantly improve diagnostics and allow doctors to optimize treatment plans.
- Genomic testing helps doctors learn more about how specific mutations, or changes in DNA, can drive cancer growth. At MSK, genomic testing is available to every patient to allow physicians to gain insight into the underlying cause of their cancer. Our researchers channeled this information, along with their clinical expertise, to create OncoKB, a precision oncology knowledge base that compiles thousands of genomic mutations that contribute to cancer growth and the corresponding drugs that are effective against those cancers. The database — the first of its kind to be partially recognized by the FDA — gives care teams a valuable tool to guide treatment decisions for people with cancer around the world.

- Mutations in the *KRAS* gene are responsible for many common cancers that have long been resistant to standard therapies. Thanks to the work of medical oncologist Bob Li and Josie Robertson Investigator Piro Lito, the FDA approved sotorasib (Lumakras™) to treat people with non-small cell lung cancer with a *KRAS* mutation — the first KRAS-blocking treatment approved for people with this disease.
- A targeted and immune-based therapy combination, lenvatinib (Lenvima®) plus pembrolizumab (Keytruda®), was approved by the FDA as a first-line combination treatment for people with advanced renal cell carcinoma, the most common kidney cancer diagnosed in adults. The success of the clinical trial, led by medical oncologist and Jack and Dorothy Byrne Chair in Clinical Oncology Robert Motzer, has changed the standard of care.
- The lenvatinib and pembrolizumab combination was also approved to treat people with advanced endometrial cancer whose disease returned after treatment, including those who have a gene mutation known as mismatch repair deficiency, which fuels tumor growth. Medical oncologist Vicky Makker led the clinical trial that demonstrated that the drug combination resulted in a 50% increase in the number of patients who experienced either a partial or complete response compared to those who received chemotherapy alone.

ADVANCES IN PATIENT CARE

New Hope for Patients Facing a Rare, Untreatable Melanoma
Medical oncologist Alexander Shoushtari and a team of collaborators have transformed the outlook for people with uveal melanoma, a rare cancer that originates in the eye and often metastasizes to the liver. In a clinical trial, they found that the immunotherapy drug tebentafusp improved survival for people with metastatic uveal melanoma — the first drug to do so for a disease that has long been considered untreatable. Study participants who received it had nearly half the risk of death in the year following treatment and were less likely to have disease progression.

Immunotherapy Keeps Bladder Cancer at Bay
Checkpoint inhibitors, a type of immunotherapy that releases the brakes on the immune system so that it can recognize and attack tumor cells, have already revolutionized the treatment of blood, breast, and many other types of cancer. Now, medical oncologist and Frederick R. Adler Senior Faculty Chair Dean Bajorin and colleagues have shown that the checkpoint inhibitor nivolumab (Opdivo®) can also help prevent the recurrence of bladder cancer. The results of a large multicenter trial showed that the drug is the first therapy to prolong disease-free survival following surgery among people with high-risk bladder cancer, possibly representing a new standard of care.

Surprising Findings in the Search for Inherited Cancer Mutations in Children
Children with cancer are not routinely screened for inherited genetic mutations associated with the disease, but a study led by pediatric oncologist and geneticist Michael Walsh and genetic counselor Elise Fiala may change that. The team sequenced healthy cells from more than 750 children treated at MSK Kids, our pediatric program, and found that 18% had a heritable mutation that predisposes them to developing cancer — a much higher number than expected. In many cases, the mutation found had no known link to the existing cancer. This research helps fill a gap in understanding the potential connections between inherited mutations and pediatric cancer, and may prompt families to take steps to reduce the risk of future cancers.

Increasing Equity in Endometrial Cancer Care

Endometrial cancer takes a disproportionate toll on Black women, who often develop more aggressive forms of the disease and are twice as likely to die from it than white women. Chief Health Equity Officer, gynecologic surgeon, and Nicholls-Biondi Chair for Health Equity Carol Brown is working to level the field in endometrial cancer with the new Endometrial Cancer Equity Program. The initiative aims to increase diversity in clinical trials to understand how genetics may play a role in the survival disparity and brings essential information about endometrial cancer symptoms to Black women at community events across the New York City region.

Novel Therapy Developed for Chronic Lymphocytic Leukemia

Prior to 2021, there were few effective treatment options for people with chronic lymphocytic leukemia, a slow-growing blood cancer that develops in the bone marrow. A clinical trial led by hematologic oncologist Anthony Mato brought a new targeted therapy known as pirtobrutinib to people with this and other blood cancers. The drug suppresses a protein that cancer cells need to grow, leading 86% of trial participants to experience a partial or complete remission when they were on the drug for 10 months or longer.

A Targeted Drug for Breast Cancer Is Helping People With Lung Cancer

Cancers with *HER2* gene mutations tend to grow more quickly than other types. Promising results from an international, multicenter clinical trial led by Dr. Li demonstrated that a drug previously approved to treat HER2-positive breast cancer is also effective against non-small cell lung cancer with the same mutation. The drug, fam-trastuzumab deruxtecan-nxki (Enhertu®), uses a HER2-targeting antibody tethered to a toxin to kill cancer cells while sparing healthy tissue. Among clinical trial enrollees with *HER2*-mutant non-small cell lung cancer, 92% experienced a reduction in tumor size, including those who previously received treatment or whose cancer had spread.

Revising the Treatment Protocol for Young People Facing Colorectal Cancer

More young people than ever are being diagnosed with colorectal cancer, and this alarming trend has led investigators to consider whether treatments should be tailored to age. In the largest study of its kind, a team of researchers led by medical oncologist Andrea Cercek compared the treatment response in people of different age groups. Surprisingly, whether patients were 30 years old or 70, they were likely to react similarly. Up until now, younger patients were given a more intense protocol of treatment. Moving forward, fewer drugs will mean fewer harmful, long-term side effects.

Surgeon-scientist Prasad Adusumilli found that CAR T cell therapy helps people with a rare form of lung cancer.

CAR T Cell Therapy Shows Promise in Treating Mesothelioma

MSK researchers pioneered the use of chimeric antigen receptor (CAR) T cell therapy, in which a patient's immune cells are removed, armed with special proteins that allow them to recognize cancer cells, and then infused back into the patient to seek and destroy cancer. Surgeon-scientist Prasad Adusumilli conducted the first trial of CAR T cell therapy in combination with pembrolizumab to treat patients with pleural mesothelioma, a rare cancer that arises in the walls of the lungs. The results of the phase I trial showed that CAR T cell therapy could offer a safe, effective treatment option for people with pleural mesothelioma.

BREAKTHROUGHS IN THE LAB

Tapping the Potential of Hybrid Immune Cells

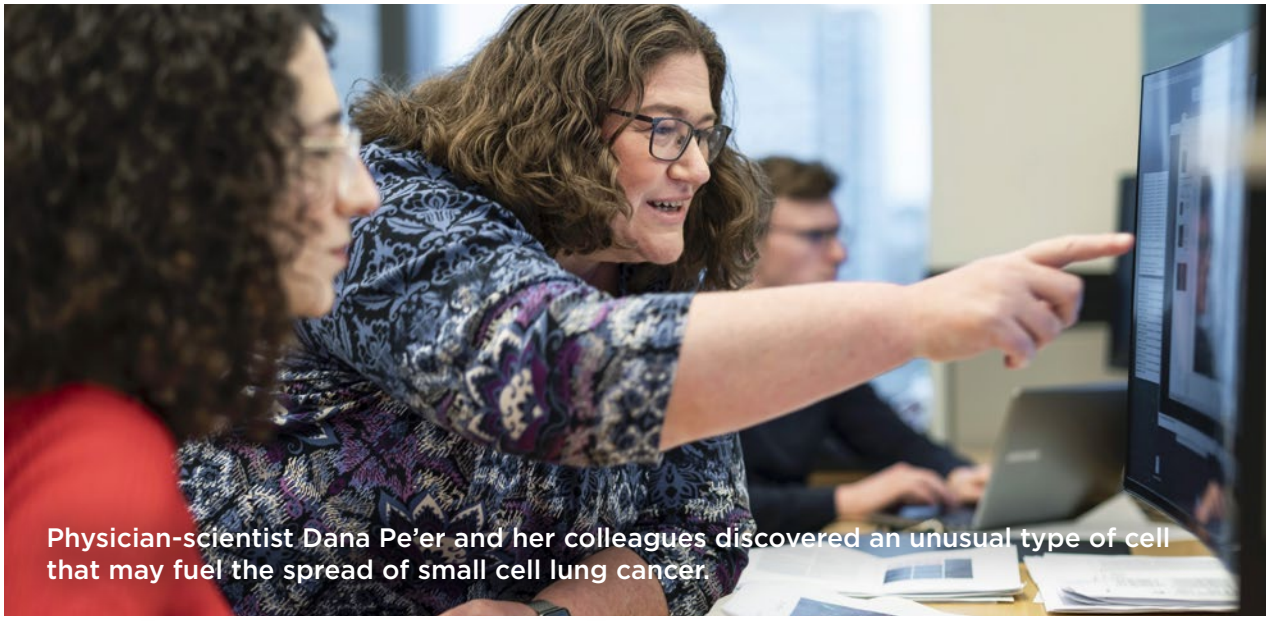
Hematologic oncologist Katharine Hsu has discovered a new type of immune cell that may be a formidable weapon against cancer. Hybrid immune cells, which form following certain infections, combine the best properties of two other immune cells — natural killer cells and T cells — making them unusually potent fighters. Better still, hybrid immune cells lack the receptors called checkpoint molecules, which dampen the body's ability to recognize and attack cancer. Dr. Hsu and her team are already using the hybrid cells to develop new immunotherapies and have reported positive results in early laboratory testing.

Controlling Chaos During Meiosis

Two decades ago, molecular biologist Scott Keeney identified the enzyme that facilitates meiosis, the process that produces sperm and egg cells and that involves precise breaks on both sides of the DNA helix to allow gene segments to shuffle between chromosomes. This year, his lab published findings that illuminate how this process is directed and controlled, ensuring that these double-strand breaks occur only at the correct locations. This discovery could improve our understanding of chemotherapy drugs that trigger cell death by interfering with their ability to repair DNA breaks and lays the groundwork for new treatment possibilities.

New Map of Aggressive Small Cell Lung Cancer Reveals Avenue for Treatment

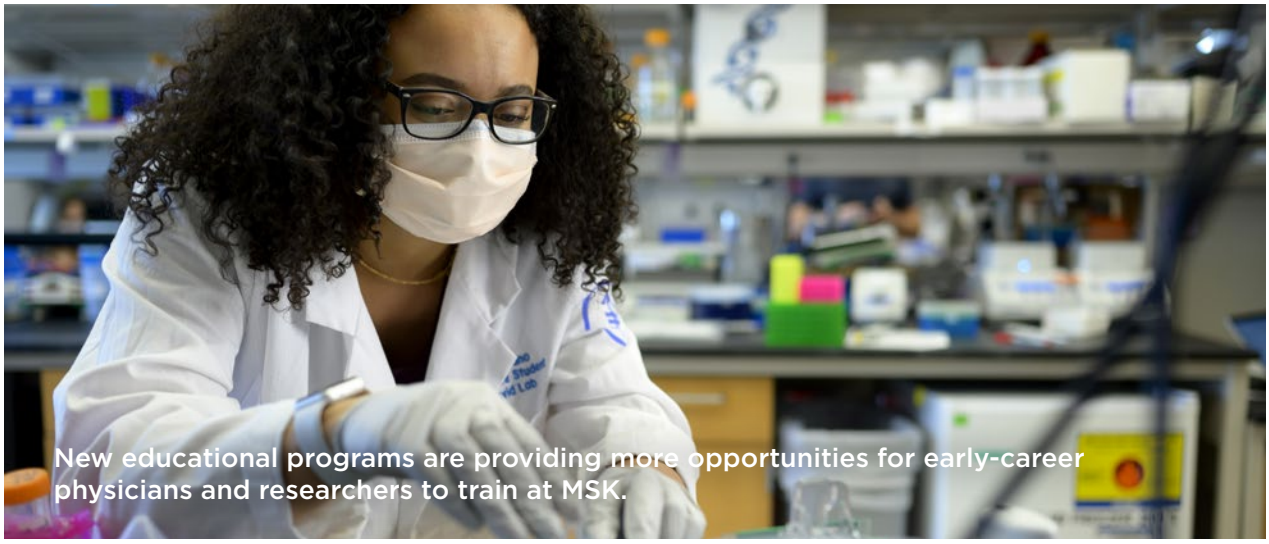
Small cell lung cancer is an aggressive, rare disease, and up until now, experts couldn't pinpoint why. Physician-scientist and Sylvia Hassenfeld Chair in Lung Cancer Research Charles Rudin teamed up with computational biologist and Alan and Sandra Gerry Chair Dana Pe'er to conduct revealing research that targeted lung cancer using the Human Tumor Atlas Network, a system of maps that can be used to track cancer's progression over time. After many years of mapping the disease to uncover a more complete view of these tumors, researchers made an exciting discovery: Small cell lung cancer tumors contain a rare population of cancer cells that have stem cell-like properties. Stem cells are special human cells that can develop into any type of cell, making them more likely to spread. The next stop for researchers is to find a way to target these cells, potentially providing a new avenue for treatment.



Physician-scientist Dana Pe'er and her colleagues discovered an unusual type of cell that may fuel the spread of small cell lung cancer.

OPPORTUNITIES IN EDUCATION

MSK is committed to ensuring that all clinicians and scientists have the opportunities and resources they need to flourish. The following initiatives will pave the way for the next generation of leaders in oncology.



New educational programs are providing more opportunities for early-career physicians and researchers to train at MSK.

Developing the Careers of Physicians From Groups Underrepresented in Science
Clinical scientists bridge the space between the laboratory and patient care. To ensure that physicians in every clinical discipline have the tools they need to succeed in research, MSK launched the Nicholls-Biondi Diversity Clinical Scientist Fellowships for Academic Careers in Cancer-Related Research. This program cements a permanent pipeline for recruiting and retaining physicians from groups historically underrepresented in science and seeks to train future leaders in cancer-related research through a three-tiered approach: enrollment in formal training, mentored research in the trainee's area of interest, and access to the MSK Loan Repayment Program to help with the high cost of medical school.

Training the Nation's Top Early-Career Physician-Scientists
In response to the urgent demand for translational researchers focused on cancer science, MSK created the Louis V. Gerstner, Jr. Physician Scholars Program. These generous and highly competitive awards will enable investigators to become skilled in the use of leading-edge tools while conducting innovative research. The program will serve as a powerful vehicle to recruit the nation's top early-career physician-scientists seeking careers in academic cancer medicine — solidifying MSK's position as a leader in translational oncology.

Increasing Representation Across the Educational Spectrum
A two-pronged initiative at MSK will establish a more diverse pool of students, residents, and clinical fellows. The Ferguson Nazareth Family Endowed Initiative for Medical Students and Residents From Historically Underrepresented Groups will provide stipends for medical students and residents, while the Ferguson Nazareth Family Clinical Fellowship in Health Equity will provide additional funding for postresidency clinical fellowships. These programs will support promising young medical students and physicians who may not have previously had the opportunity to gain valuable oncology experience at a top cancer institution, while providing MSK with the benefits of an increasingly diverse workforce. MSK is actively building collaborations with historically Black colleges and universities, including Morehouse College and Howard University, making it possible to recruit and retain top talent from the Black community and other underrepresented groups in science.