SPRING 2020

MSK News

MEMORIAL SLOAN KETTERING CANCER CENTER

The Big Break

Maria Jasin and the Discovery That Launched Genome Editing

Photo: Karsten Moran

INSIDE: An Update about COVID-19

DEAR READERS,

Since Memorial Sloan Kettering opened its doors in 1884, our patients have been at the center of everything we do.

As this issue of *MSK News* went to print, our community was grappling with the unprecedented and evolving COVID-19 pandemic. Inside this issue, we feature an interview with Mini Kamboj, our Chief Medical Epidemiologist, whose expertise has been invaluable to our MSK community. It is because of all our staff members, including Dr. Kamboj, that we remain prepared, responsive, and optimistic about our capabilities in the midst of this ever-changing situation.

We remain committed to keeping you informed throughout it all. Please visit **mskcc.org/coronavirus** to learn more about our policies to protect our patients and staff. Information on that web page is updated regularly.

As always, the health and safety of our patients and staff is our top priority, and our mission to provide the best cancer care to every person we treat remains steadfast.

—The *MSK News* Editorial Team

CYCLE FOR SURVIVAL PASSES $260 MILLION

By Jim Stallard

"Thanks to MSK and Cycle for Survival's mission, I get to rewrite my story," says Barbie Cervoni, one of thousands of participants who rode this year to raise money for rare cancer research at Memorial Sloan Kettering. Diagnosed with thymoma 12 years ago, Barbie, now 37, took part in her seventh Cycle for Survival to help create a better future for people with a rare cancer.

Cycle for Survival started as a single indoor ride in New York City and, over 14 years, has grown into a national movement that has received support from over 1 million individuals and companies. Due to the COVID-19 pandemic, Cycle for Survival made the difficult but necessary decision to cancel the final three days of events in 2020. But still, the entire community of participants stayed focused on raising money to make a difference in the fight to beat rare cancers.

Every dollar raised through Cycle for Survival goes directly to research for rare cancers, which affect about half of all people with cancer. The category includes thyroid, brain, ovarian, pancreatic, and all pediatric cancers. The money is distributed to researchers within six months of the event to accelerate progress through innovative studies and clinical trials of new drugs and treatments.

Since her last treatment in 2019, Barbie says she is the strongest she has ever been physically and is living life with love and gratitude. "Make no mistake, I will keep fighting and raising money for rare cancer," she says.

Go to **www.cycleforsurvival.org** to learn more. ●

Barbie Cervoni took part in her seventh Cycle for Survival. Photo: Courtesy of Cycle for Survival

MSK ENTERS A NEW ERA

By Jim Stallard

The David H. Koch Center for Cancer Care at Memorial Sloan Kettering Cancer Center provides nearly every aspect of cancer care across numerous specialties. Photo: Karsten Moran

The David H. Koch Center for Cancer Care at Memorial Sloan Kettering Cancer Center began welcoming patients for treatment on January 20, 2020.

"This remarkable building creates the space, in every sense of the word, for our breakthrough research and therapies to stand in lockstep with our steadfast commitment to truly care for each person as an individual," said MSK Physician-in-Chief and Chief Medical Officer Lisa DeAngelis.

The building on Manhattan's Upper East Side has 25 floors, 231 exam rooms, 110 infusion rooms, 37 procedure rooms, and 16 inpatient beds for people requiring a short stay. Approximately 1,300 patients will be seen there each day.

MSK leadership and Julia F. Koch (center, in black) celebrate the opening of the David. H. Koch Center for Cancer Care at Memorial Sloan Kettering Cancer Center on December 10, 2019. Photo: Rick DeWitt

Nearly every aspect of cancer care across numerous specialties, from radiation therapy to stem cell transplants to rehabilitation therapy, is available under one roof. An entire floor is dedicated to early-stage clinical trials. The building — the largest freestanding cancer care facility in New York City — was made possible by a landmark donation of $150 million from the late David H. Koch, who served as a longtime member of MSK's Boards of Overseers and Managers.

"My husband saw in this center the potential to transform cancer care around the world, and today his vision becomes reality," said Julia F. Koch, who joined in the ceremony. "David's legacy of leadership and generosity will persist through this state-of-the-art facility and the lifesaving work of this team."

"This facility expands on MSK's rich history of innovation in patient care and combines the latest, most intuitive technology with the compassionate, efficient care of our staff," said MSK President and CEO Craig Thompson. ●

INFECTIOUS DISEASE SPECIALIST

Mini Kamboj Discusses COVID-19

By Jim Stallard

COVID-19 emerged as a major threat to public health in the United States in early 2020. Memorial Sloan Kettering Chief Medical Epidemiologist and infectious disease expert Mini Kamboj shares some facts about COVID-19, what people with cancer should know, and how MSK is keeping our patients and staff safe.

What are coronaviruses, and what is different about COVID-19?
Coronaviruses make up a large family of viruses that have been around for years. They were first identified and described in the 1960s. I tell my patients they probably have already encountered a coronavirus at some point in their lives.

The COVID-19 coronavirus is a new strain that has the potential to cause more severe illness. It is thought to have originated in animals before spreading to humans, similar to two other well-known coronaviruses, SARS (severe acute respiratory syndrome) and MERS (Middle East respiratory syndrome). COVID-19 was first identified in humans in Wuhan, China, in 2019.

How does COVID-19 spread?
COVID-19 primarily spreads from person to person through droplets when a person with it coughs or sneezes close to another person. This is the same way the common cold and flu spread.

What are the signs of COVID-19?
COVID-19 causes cold or flu-like symptoms. These may include fever, cough, or difficulty breathing. It can cause serious problems, such as pneumonia and even death, especially in older people and people with other health problems, including cancer.

With community spread of COVID-19, what can I do to keep myself safe?
The best way is to limit exposure to the virus by staying home and avoiding gatherings. If you go outside, keep a safe distance from other people, at least six feet. Wash your hands frequently and disinfect areas that you touch often. If you start having symptoms of COVID-19, call your doctor for guidance on the next step. If someone in your household has symptoms, maintain a safe distance from them, preferably in a separate room. At MSK and other hospitals, some appointments may be canceled or postponed. This is for patients' own safety.

Should my healthcare provider always wear a mask?
We're telling all MSK staff members who are working in our clinical locations that they are required to wear a mask throughout their entire shift. There are several different types of masks, and the specific type we require our staff to wear depends on how closely the staff member is interacting with patients, including COVID-19 patients, and what procedures they may be doing.

At the same time, we remind both staff and patients that masks are not a substitute for essential practices, like washing your hands, and taking other precautions. People should not have a false sense of security because they are wearing a mask. Anyone with cold or flu-like symptoms should stay home to protect others.

Are there special concerns for people with cancer?
People with cancer often have weakened immune systems. This is referred to as being immunocompromised. This is usually due to treatment for their cancer, such as a bone marrow transplant for blood cancer or chemotherapy for certain types of leukemia. But people can also become immunocompromised from radiation therapy or surgery. Having a weak immune system makes it harder for the body to fight off diseases and infections, including the common cold, flu, COVID-19, and more.

MSK staff are highly trained at screening for and managing infectious diseases, such as COVID-19. We are taking extensive precautions to protect our patients by minimizing their risk of exposure to the virus and ensuring that our doctors and nurses are healthy and available to care for them. •

"MSK staff are highly trained at screening for and managing infectious diseases, such as COVID-19."

— Mini Kamboj

The Big Break

Maria Jasin and the Discovery That Launched Gene Editing

By Matt Tontonoz

Maria Jasin woke up groggy from jet lag in her Paris hotel room. It was May 21, 2019. She was in the city for a scientific conference and later that morning would be heading over to the venue. But first she checked her email.

There, sitting in her inbox, was a message from the Shaw Foundation, a Hong Kong–based organization that bestows one of the most important prizes in science. She opened it and stared in disbelief.

"I thought at first they were asking me to nominate a potential prizewinner," Dr. Jasin recalls. "It took me a moment to realize they were notifying me I was the winner."

Known as the "Nobel of the East," the Shaw Prize in Life Science and Medicine is given to scientists whose research has greatly benefited humanity. It comes with a cash award of $1.2 million. Dr. Jasin, a member of the Developmental Biology Program in the Sloan Kettering Institute, was being recognized for her discoveries about DNA repair. Cells use this process to fix DNA when it becomes damaged by, say, sunlight, smoking, or radiation.

Dr. Jasin began conducting her pioneering research in the 1990s. Her work eventually led to today's cutting-edge tools for genome editing. With these methods of molecular cut and paste, scientists can make precise changes to genes, the units of heredity that specify what color your eyes are, if you'll be tall or short, and even whether or not you have a predisposition to cancer. Genome-editing techniques offer the potential to cure people who have diseases due to inherited or acquired genetic changes.

It wasn't a straightforward path from discovery to breakthrough — science rarely takes this route. But it was Dr. Jasin who started it all. As a recent chronicler of the genome-editing field wrote in 2018, Dr. Jasin's findings were "the first key discovery of the Age of Editing."

Maria Jasin (left) and Hong Kong Chief Executive Carrie Lam at the Shaw Prize ceremony. Photo: Courtesy of the Shaw Prize Foundation

Creative Destruction

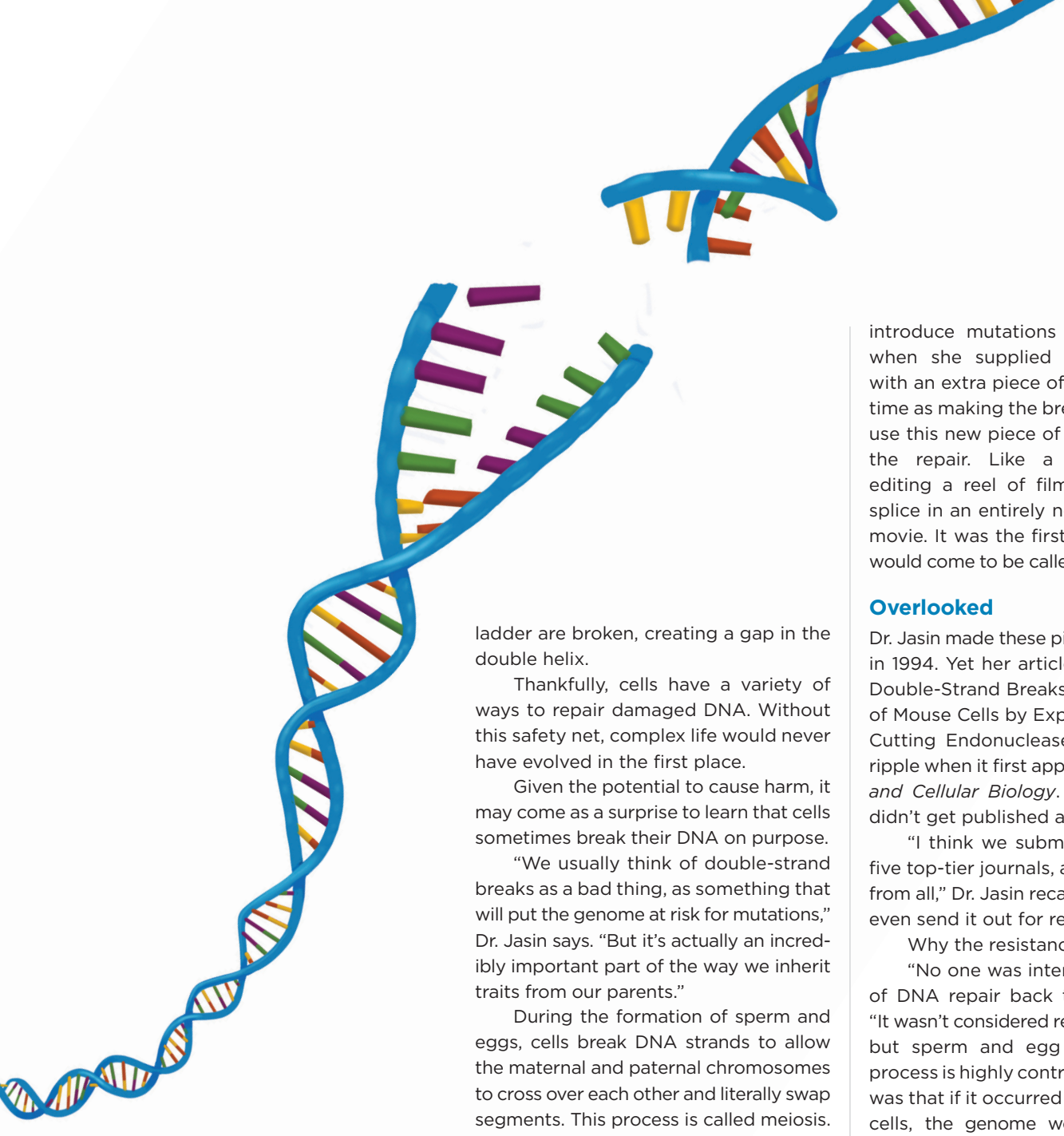
Because DNA is the blueprint for life, any damage is destined to cause trouble. The DNA in our cells is constantly being nicked and bruised by environmental toxins and the normal wear and tear of growth. If not repaired, this damage can lead to mutations: permanent changes to our genetic information.

Some kinds of DNA damage are worse than others. It's like a car accident: You can have a fender bender, be sideswiped, or get T-boned. The worst kind of DNA damage of all — akin to a totaled car — is called a double-strand break. This is when both sides of the DNA

"I think we submitted it to four or five top-tier journals, and it got rejected from all. *Science* didn't even send it out for review."

— Maria Jasin

Photo: Karsten Moran



DNA can be likened to a spiral ladder. A DNA double-strand break is when both sides of the ladder are interrupted, creating a gap in the helix. Illustration: Terry Helms

ladder are broken, creating a gap in the double helix.

Thankfully, cells have a variety of ways to repair damaged DNA. Without this safety net, complex life would never have evolved in the first place.

Given the potential to cause harm, it may come as a surprise to learn that cells sometimes break their DNA on purpose.

"We usually think of double-strand breaks as a bad thing, as something that will put the genome at risk for mutations," Dr. Jasin says. "But it's actually an incredibly important part of the way we inherit traits from our parents."

During the formation of sperm and eggs, cells break DNA strands to allow the maternal and paternal chromosomes to cross over each other and literally swap segments. This process is called meiosis. Together with SKI molecular biologist Scott Keeney, Dr. Jasin has been studying meiosis for more than 20 years. She explains that the intentional breaking and swapping is in large part why you look similar but not identical to your siblings: You each have a slightly different combination of genes from your mother and father as a result of this shuffling that occurs even before conception.

As a new member of SKI in the mid-1990s, Dr. Jasin made a startling discovery about the making and fixing of those breaks. She found a way to introduce a double-strand break at a specific spot in a mouse chromosome. The cell would repair the break but introduce mutations at the spot. But when she supplied the chromosome with an extra piece of DNA at the same time as making the break, the cell would use this new piece of DNA to complete the repair. Like a cinematographer editing a reel of film, Dr. Jasin could splice in an entirely new scene into the movie. It was the first example of what would come to be called genome editing.

Overlooked

Dr. Jasin made these pivotal observations in 1994. Yet her article "Introduction of Double-Strand Breaks into the Genome of Mouse Cells by Expression of a Rare-Cutting Endonuclease" hardly made a ripple when it first appeared in *Molecular and Cellular Biology*. In fact, it almost didn't get published at all.

"I think we submitted it to four or five top-tier journals, and it got rejected from all," Dr. Jasin recalls. "*Science* didn't even send it out for review."

Why the resistance?

"No one was interested in this type of DNA repair back then," she recalls. "It wasn't considered relevant to anything but sperm and egg cells, where the process is highly controlled. The thought was that if it occurred in somatic [body] cells, the genome would rearrange at sequence repeats and cause disease."

What's more, there were other ways to modify genes at the time. These methods were somewhat crude, and they were incredibly labor-intensive, but they got the job done without involving a DNA break. As a result, although Dr. Jasin saw how her findings could take genetic engineering to the next level, few others did.

The tide began to shift in the late 1990s. That's when scientists were becoming interested in two recently discovered cancer-related genes, *BRCA1* and *BRCA2*. Women with mutations in either of these genes, doctors learned, were at a greatly increased risk of devel-

Maria Jasin with breast oncologist Mary Ellen Moynahan (right) in 1998. Photo: MSK Archives

From Breaks to Breakthroughs

Maria Jasin's discoveries have led to concrete advances in patient care. The targeted medicines called PARP inhibitors, for example, are based on knowledge gained from her work. These drugs take advantage of the fact that tumors with a BRCA mutation are less able to repair DNA damage than normal cells; DNA damage builds up in the cancer cells, and they eventually die.

"Dr. Jasin's discoveries were absolutely foundational for the development of PARP inhibitors as a treatment for an expanding list of cancers," says Mark Robson, Chief of the Breast Medicine Service at MSK.

He notes that PARP inhibitors are now considered one of the most promising recent developments in treating BRCA-mutated cancers, including breast, ovarian, prostate, and pancreatic cancers. The US Food and Drug Administration approved these drugs for use in BRCA-mutated pancreatic cancer in 2019. They were already approved for BRCA-mutated breast and ovarian cancers. •

oping breast cancer, and they developed the disease at a much earlier age. It wasn't yet clear why mutations in these genes caused cancer. But tantalizing new evidence would soon emerge.

Once again, Dr. Jasin's contributions were crucial. In 1999, she and a breast oncologist working in her lab, Mary Ellen Moynahan, were the first to show that cells need a working version of the protein made from the *BRCA1* gene to properly repair DNA double-strand breaks. When this protein is hobbled by a mutation, it cannot do its job. DNA damage that would normally be fixed goes unrepaired or is repaired incorrectly. Cancer is the nearly inevitable result.

For Dr. Jasin, the timing of this interest in the BRCA genes couldn't have been better. "We were the ones with the molecular tools to actually address this question of what *BRCA1* was doing in cells because of our prior work on double-strand breaks," she says. "Here I was, one of the few people studying repair of these breaks. I'm at a cancer center. These genes are important in suppressing breast cancer, and they do so by using the type of repair that we study in the lab."

It was quite a bit of scientific serendipity. But for Dr. Jasin, it was also deeply personal. Her own mother had died of breast cancer when Dr. Jasin was young. Finding a scientific project that might contribute to the understanding of the disease was never far from her mind.

"I remember when I was a postdoc at Stanford inquiring about what kind of research people do in breast cancer," Dr. Jasin recalls. "At that point in time, I didn't really see an angle for me to get into that area. But things just came together when the BRCA genes were discovered."

Search and Replace

With the BRCA-related discoveries, scientists were finally realizing the importance of this type of DNA repair, called homologous recombination, to cancer suppression. But finding a way to apply this knowledge to genome editing was still a ways off.

One nagging feature prevented the method from gaining traction: "Our 1994 paper showed why you would want

Maria Jasin at the Shaw Prize ceremony. Photo: Courtesy of the Shaw Prize Foundation

to put breaks in the genome — as a way to make edits to genes," she says. "But we couldn't make these breaks wherever we wanted to make them." In other words, she could only edit one small corner of the genome, not edit any spot she wished.

Fortunately, a few researchers who had grasped the potential of Dr. Jasin's findings were hot on this trail. They delivered the first, tentative methods for breaking DNA at specific locations around 2003.

What really caused the scientific world to stand up and take notice of Dr. Jasin's work, however, was the discovery that bacteria had already solved this problem better than any scientist could have engineered. In 2012, researchers at the University of California, Berkeley, and the Massachusetts Institute of Technology identified a system of immune defense in bacteria called CRISPR-Cas9. This versatile enzyme complex defends bacteria against viruses by finding and chopping up specific viral DNA sequences, causing the virus to fall apart. CRISPR's discoverers realized immediately that this bacterial find-and-cut system could be adapted into a genome-editing tool.

This was exactly the sort of targeted DNA-breaking method that Dr. Jasin and others had been dreaming of. Suddenly, with CRISPR they could make a cut at essentially any spot in the genome and then — using Dr. Jasin's approach — swap in any piece of DNA they wanted or simply let the cell create mutations. It was a revolutionary advance.

"Maria was a true pioneer," says Joan Massagué, Director of SKI, who recruited her to join the institute. "I watched as she faced indifference early on, and it's gratifying now to see her being acclaimed for the singularity and importance of her findings."

Today, thanks in part to Dr. Jasin, scientists are using genome editing to achieve amazing results. Right here at MSK, they are using these tools to engineer more-powerful immunotherapies to treat cancer, for example. Elsewhere, scientists have used CRISPR to fix the genetic mistake that leads to sickle cell anemia, an inherited condition that causes blood clots and intense pain.

Not bad for a discovery that flew under the radar for more than a decade.

"I sometimes wonder if our paper had been accepted in a more prominent journal, whether genome editing would have come sooner," Dr. Jasin says.

Perhaps. But then again, sometimes the best science comes when no one is looking. •

Harnessing the Power of Data for Patient Care

By Julie Grisham

It was July 17, 2017, when Albert Kuchler found an unusual lump in his neck. As a retired oral surgeon, he knew this was cause for concern. He called his friend and colleague Jatin Shah, a member of Memorial Sloan Kettering's Head and Neck Service, to see if he could come in for an appointment. Dr. Shah was able to see him the very next day, and soon after, pathology tests revealed that Albert had salivary gland cancer.

Albert, now 66, was treated with radiation and surgery by a team of doctors, including Ian Ganly, Josh Yamada, Nancy Lee, and Loren Michel. Treatment went well for a few months, but then a scan showed that Albert's cancer was spreading: first to his spine and hip, and then to his liver and lung. There was no obvious next step for treatment.

"Things were not going well for me at that point, to put it mildly," Albert says. "The cancer was really aggressive."

He understood how difficult this cancer was to control and how limited his options were for successful treatment. Salivary gland cancer is rare, and researchers are still learning what causes it to grow and spread.

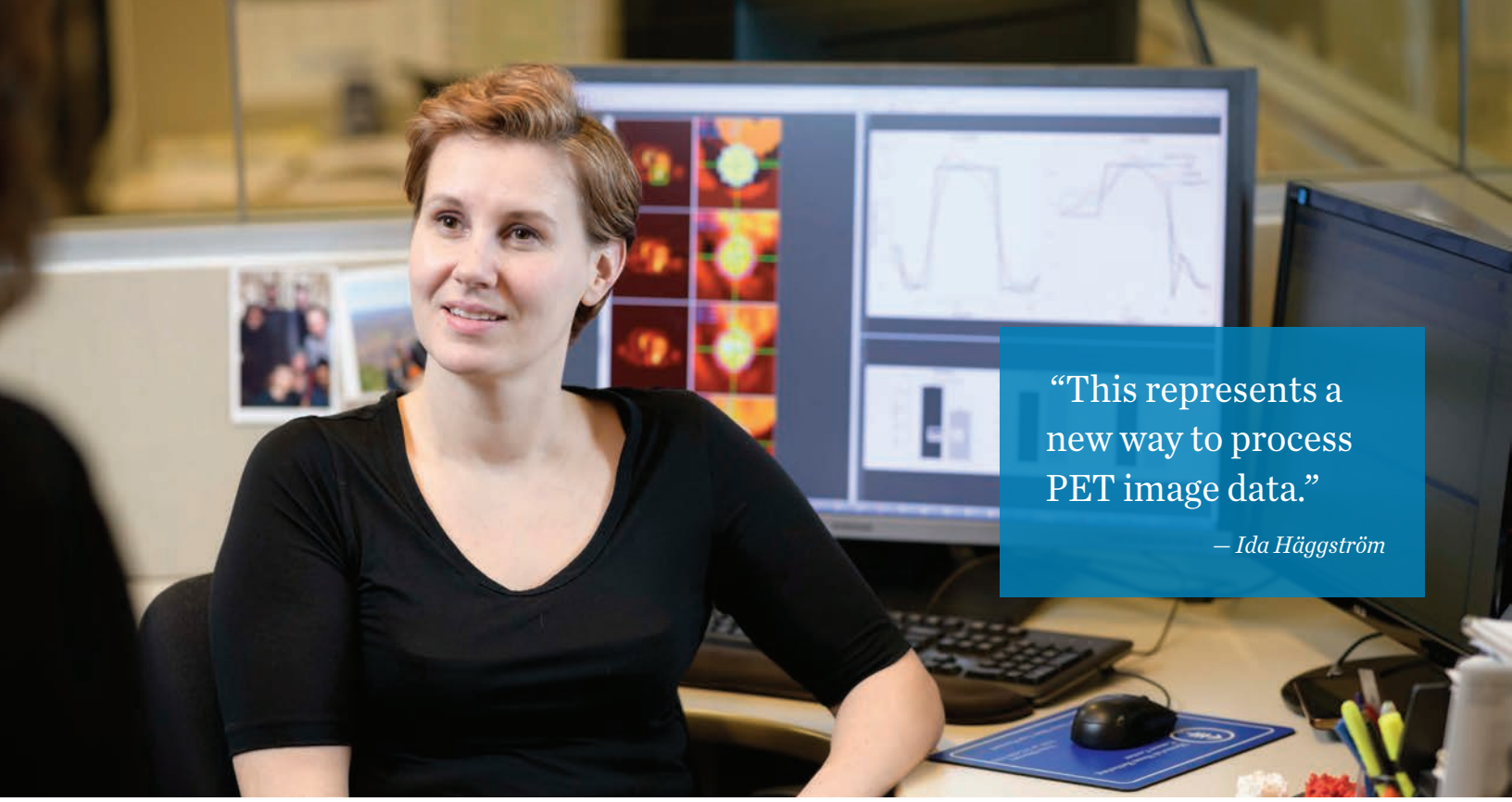
Albert's doctors analyzed his cancer with MSK-IMPACT™, a test that scans tumors for genetic changes known to play a role in cancer. They learned that Albert's tumors were driven by HER2 amplification, causing an excessive amount of the HER2 protein to be present on tumor cells. This characteristic is usually associated with breast cancer and stomach cancer. Albert's doctors promptly recommended that he see Bob Li, a medical oncologist and drug development scientist at MSK.

"HER2 amplification is found in about 8 percent of salivary gland cancers," says Dr. Li.

Albert now had a path forward. He enrolled in a clinical trial looking at a drug called ado-trastuzumab emtansine (Kadcyla®) in salivary gland tumors with high levels of HER2.

"The challenge of developing trials like this is finding more people with the right genetic mutation so that we're able to offer them these potentially

After genetic testing of his tumor, Albert Kuchler (left) enrolled in a clinical trial led by medical oncologist Bob Li. Photo: Kreg Holt



Medical physics researcher Ida Häggström is using a technology called deep learning to improve PET scans.
Photo: Rick DeWitt

lifesaving treatments,” Dr. Li says. “Without MSK-IMPACT, we would not have found this new treatment for Albert.”

MSK-IMPACT uses cutting-edge, next-generation DNA sequencing to look for mutations and other critical changes in the genes of both rare and common cancers. The test has been used at MSK since 2014.

The Role of Machine Learning

MSK-IMPACT is possible because advances in computing and data science allow doctors to find mutations in thousands of cells. Once those mutations are identified, patients can be matched with the most-appropriate treatments.

Some 50,000 tumors have already been studied with MSK-IMPACT. The massive amount of data collected creates unique opportunities for analysis. One way to harness these data is by using artificial intelligence techniques, like machine learning. With machine learning, computers are trained to use large quantities of data to detect patterns and make predictions based on those patterns. Machine learning powers many things in our daily lives: Netflix recommendations, real-time driving directions, and more.

But while machine learning is playing an increasingly important role in medical decision-making, according to Sloan Kettering Institute computational biologist Quaid Morris, it is not a replacement for the judgment of doctors like Dr. Li and his colleagues.

“We employ artificial intelligence when there’s simply too much data for a human to look at,” says Dr. Morris, who recently was recruited to MSK to broaden the application of machine learning to new areas. “Machine learning helps make doctors better at their jobs.”

Learning about Tumors That Evade a Simple Diagnosis

Machine learning has the potential to further revolutionize patient care through new applications using MSK-IMPACT data. One of these applications is the development of diagnostic methods for tumors that are not easy to categorize.

In a study published in *JAMA Oncology* in November 2019 and led by cancer geneticist Michael Berger and computational oncologist Barry Taylor, MSK investigators reported on an algorithm that helps determine where in the body a tumor originated. This is possible, Dr. Berger says, because a cancer may have particular genetic changes depending on where it starts. Between 2 and 5 percent of all cancers are classified as cancer of unknown primary (CUP). This means that the place in the body where the cancer began cannot be determined.

Using machine learning, doctors can analyze and understand genetic patterns to figure out where a case of CUP started. According to Dr. Berger, even with treatments that target tumors based on their genetics, it’s still important to identify where a tumor started to be able to offer the most-appropriate drug.

“Machine learning has enabled us to develop extremely powerful new methods for diagnosing challenging cancers,” Dr. Taylor says. “We hope to validate more of these tools so they can be applied to patient care.”

“Contributions from donors have been very important in helping us establish these data sets,” Dr. Berger explains, “particularly philanthropy received through the Marie-Josée and Henry R. Kravis Center for Molecular Oncology and Cycle for Survival.” (Cycle for Survival is MSK’s indoor-cycling event, which raises money for rare cancer research. Read more about it on page 2.)

Getting a Better View inside the Body

Another way investigators are using machine learning is to improve PET scans, one of several imaging technologies used to diagnose cancer and determine if a treatment is working. These scans allow doctors to see activity in cells, including the rapid growth that distinguishes tumors from healthy tissue.

However, with current techniques it takes a long time to process the data that are generated with PET scans and to create images that can be interpreted by radiologists. Additionally, the images are sometimes blurry. MSK researchers have used a kind of machine learning called deep learning to look for a better approach.

"We wanted the computer to learn how to use data to construct an image," says medical physics researcher Ida Häggström. "This represents a new way to process PET image data."

Dr. Häggström and her colleagues, including medical physicist Ross Schmidtlein and data scientist Thomas Fuchs, named their technique DeepPET. According to a paper they published in *Medical Image Analysis* in May 2019, the method generates images more than 100 times faster than conventional techniques. The pictures are also much clearer than those made with current PET technologies.

The team is getting the system ready for clinical testing. "The gain we've seen in speed and image quality should lead to more-efficient image evaluation and more-reliable diagnoses and treatment decisions," Dr. Häggström says. "Ultimately, it can result in improved care for our patients."

New Research Methods, New Challenges

Machine learning is useful for more than making sense of data sets from patients. It can also parse data sets from individual cells being studied in the laboratory.

How do immune cells and tumor cells interact? Which molecular changes enable tumors to spread beyond the organ where they originally formed? These are just some of the questions being addressed by Dana Pe'er, Chair of the Computational and Systems Biology Program in SKI. Dr. Pe'er is a leader in

> "Machine learning has enabled us to develop extremely powerful new methods for diagnosing challenging cancers."
>
> *— Barry Taylor*

Operations engineer Ajay Sharma works in the MSK laboratory that developed MSK-IMPACT™.
Photo: Rick DeWitt

Computational and Systems Biology Program Chair Dana Pe'er (right), here with research scholar Esther Wershof, is a leader in developing computer algorithms to make sense of data from single-cell analysis. Photo: Karsten Moran

developing machine learning algorithms to address fundamental questions in biomedical science, including how to analyze the huge amount of data that comes from analyzing the molecular information in every cell in a tissue sample as part of lab research.

Dr. Pe'er collaborates with investigators throughout SKI and the rest of MSK to help researchers make sense of complex molecular changes and figure out which ones are significant.

In one recent study, published in *Nature Medicine*, she and SKI Director Joan Massagué led a team that found uncanny parallels between lung cancer cells that are able to metastasize (spread) to other parts of the body and the stem cells involved in lung development and wound repair. The investigators analyzed genetic information from 40,000 individual cells from 17 tissue samples taken from patients. They then used advanced computational methods developed in Dr. Pe'er's lab to interpret this head-spinning amount of data. The findings lend support to the idea that a metastasis can be viewed as a dysfunctional organ that grows in the wrong place.

Sohrab Shah, MSK's Chief of Computational Oncology, is also using machine learning to address the flood of information that results when cells are studied one at a time.

In a study published in *Cell* in November 2019, he and his collaborators sequenced the genomes of nearly 52,000 individual cells and analyzed how these genomes changed over time. This allowed them to pinpoint the mutations that gave rise to a particular tumor and determine how certain groups of cancer cells evolved.

Understanding how tumors change over time is essential to finding ways to detect them early and stop their growth sooner. The study of tumor evolution is also important for learning how cancer cells develop resistance to treatment. In the future, these applications have the potential to further revolutionize cancer care.

Using Innovative Technology Today

As Albert's story demonstrates, however, the power of computational biology and data science is already here.

After just two infusions of ado-trastuzumab emtansine, all of his tumors completely vanished, and his bones were healing. "My scans were remarkable, to say the least," Albert says. "My response to the drug was as good as you could possibly get." More than a year later, he shows no evidence of disease.

Albert says side effects from the treatment have been minimal. He will continue to receive infusions of the drug every three to four weeks for as long as it works.

Once an avid golfer, Albert is not quite ready to take up his clubs because his spine is still healing, but he has returned to his golf-related volunteer work — he acts as a referee at United States Golf Association amateur tournaments across the country and at New Jersey State Golf Association professional and amateur tournaments. "It's been great to get off the hamster wheel of treatment and start to participate in my hobbies again," he says. "I'm very grateful for the opportunity to participate in this trial." •

Looking for Patterns in Cancer Survivors

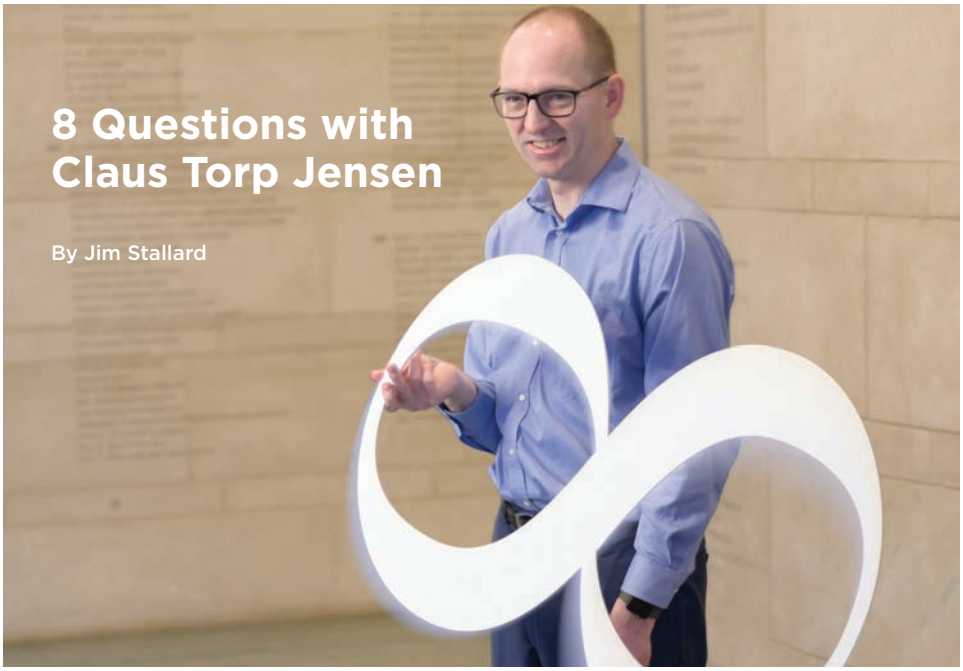
Cancer treatment is complex. For every type of cancer, there is a range of treatments, side effects, and outcomes — both short-term and those that arise years later. Machine learning can help make sense of these variables, according to Sloan Kettering Institute computational biologist Quaid Morris. One area that Dr. Morris is focused on is using machine learning to study cancer survivorship.

"Wouldn't it be great if a computer could scan all of a patient's medical records and find signs that indicate some potential risk?" he asks. "This includes making sense of handwritten and typed notes in someone's medical record, finding patterns, and then flagging any warnings so a clinician could take a more in-depth look at them."

This application of machine learning could lead to better tools for predicting disease recurrence as well as chronic health problems that may result from cancer or its treatment, Dr. Morris explains.

"Machine learning can be used to identify unanticipated patterns in very large databases," he concludes. "MSK has a lot of patients, and hundreds of thousands of records have been collected for decades. This is the kind of data we need to detect complex patterns of interaction and anticipate how these connections will play out in patients in the future." •

Computational biologist Quaid Morris recently joined MSK to broaden the application of machine learning. Photo: Rick DeWitt



8 Questions with Claus Torp Jensen

By Jim Stallard

Photo: Rick DeWitt

Claus Torp Jensen recently joined Memorial Sloan Kettering as the institution's first Chief Digital Officer and Head of Technology. He is spearheading efforts to adopt and incorporate digital technology into all daily activity at MSK.

What exactly does a Chief Digital Officer do?
My job title doesn't have a standard definition. At MSK, I see my role as helping decide how we integrate the physical space and the digital space. There's a misconception that digital technology is all about new apps. New apps in a hospital might mean that something on a phone or computer would streamline an existing process. But using digital technology is much more than that. It's about changing the day-to-day experience of cancer care and prevention.

For example, what if doctors could help patients manage symptoms by monitoring them continuously at home to see how they are eating or sleeping or if they are getting exercise? On the research side, we could search for clues about how to better combat cancer by connecting clinical data with genomic insights. My task is to define that vision, determine where we should focus our efforts, and turn it into action.

How can new digital technology help MSK better fulfill its mission?
MSK is proud of its core mission of conquering cancer. We won't change who we are. But there are physical constraints: We have a certain number of buildings, and there are only so many doctors and nurses available to care for patients. We must find a way to help more people and increase our influence in cancer care. With digital tools, we can help prevent cancer through education and advice. MSK could become a digital hub where all types of people go for advice and assistance relating to cancer.

Were you into technology from a young age?
I decided I wanted to do computer science in eighth grade. I grew up in Denmark, and my Latin teacher's husband was one of the first in the country to get a computer science degree, which sparked my interest. This was 1981, and I bought a Sinclair ZX81, the first home computer. I wrote a program on it to help me practice Latin verbs.

Do you have any rules about technology at home?
I have two daughters in high school, and we have a lot of technology in our house. I can't really control what they do on the Internet, so my one rule is to stay secure. Protect your personal information and your credit card information, and don't get a computer virus.

What would your ideal second career be?
I love teaching. I did not expect it would be something I enjoyed so much, but in college I was a substitute teacher in computer science for six years. If I get to a point where I no longer want to have an intensive executive career driving industry level changes, I might go back to trying to help people become better — one person at a time.

What are your favorite things to do outside of work?
I love to read science fiction. I also love traveling, especially going on cruises. Give me a cruise ship and some interesting places to go and I will enjoy it. I dream of doing an around-the-world cruise when I retire.

Is it true you are in the *Guinness Book of World Records*?
Yes! In 1987 in Denmark, four of us set the record for the world's largest solitaire game. We used 200 decks of cards in a gymnasium and had to complete it within 12 hours. It was not nearly as easy as we expected — it required a lot of exhausting running from one end of the gymnasium to the other!

What makes you most excited to come to work each day?
The people. When I got my computer science degree, I expected to be a techie sitting in a corner at my computer. But I really enjoy connecting with people, helping people, and helping organizations change. I want to help create change at MSK so that I can contribute to a better team, a better institution, and a better world. •

From left: Kate Allen, President of The Society of MSK; Andrew Kung, Chair of MSK's Department of Pediatrics; and Alison Loehnis, President of Net-a-Porter.

WINTER LUNCH CONTINUES MOMENTUM IN RAISING FUNDS FOR PEDIATRIC CANCER RESEARCH

By Andrew Roth

On February 5, The Society of Memorial Sloan Kettering hosted its seventh annual Winter Lunch to support its Precision Medicine for MSK Kids initiative. More than 275 guests attended this year's event, which was sponsored by Net-a-Porter for the fifth consecutive year, at the Rainbow Room in Rockefeller Center.

The lunch featured special guest speaker Andrew Kung, Chair of the Department of Pediatrics. He spoke about the current landscape of pediatric cancer care and research as well as what's on the horizon. He called out the impact of philanthropic partners like The Society, which has raised more than $2 million to power research at MSK Kids since 2015.

"The outlook for childhood cancer has changed," Dr. Kung said at the event. "When I started medical school, only 20 percent of children diagnosed with cancer survived their disease. Thirty years later, 80 percent of children with cancer are cured."

Still, he said, there is more work to be done.

"For any parent whose child has cancer, 80 percent is not good enough, and it's not good enough for a pediatric oncologist either," he said.

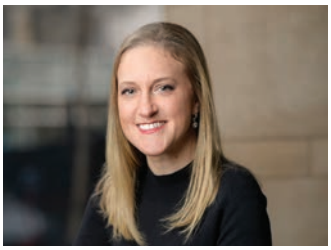
Doctors and researchers at MSK Kids are making strides toward increasing the cure rate for childhood cancer through an approach called precision medicine. With this method, doctors identify the genetic mutations that make a child's tumor grow so they can use the best drugs to slow or stop it. "The goal is to be able to consistently match the right drug to the right patient at the right time," Dr. Kung said.

MSK Kids has built significant momentum toward that new era, he said, which would not be possible without philanthropic support.

"On behalf of our patients at MSK Kids," Dr. Kung said in his closing remarks, "I thank The Society for the support that allows us to bring the precision cancer medicine program of tomorrow to the children of today who simply cannot wait." •

The Society of Memorial Sloan Kettering, founded in 1946, is a volunteer-led organization within MSK dedicated to promoting the well-being of patients, supporting cancer research, and providing public education on the early prevention, detection, and treatment of cancer.

APPOINTMENTS AND PROMOTIONS



Amy Lowery-Allison
Psychologist
Appointed as Associate Clinical Member; Department of Psychiatry & Behavioral Sciences, Psychiatry Service

Jacqueline Bromberg
Medical Oncologist
Promoted to Clinical Member; Department of Medicine, Division of Solid Tumor Oncology, Breast Medicine Service

Martin Chin
Psychiatrist
Appointed as Clinical Member; Department of Psychiatry & Behavioral Sciences, Psychiatry Service

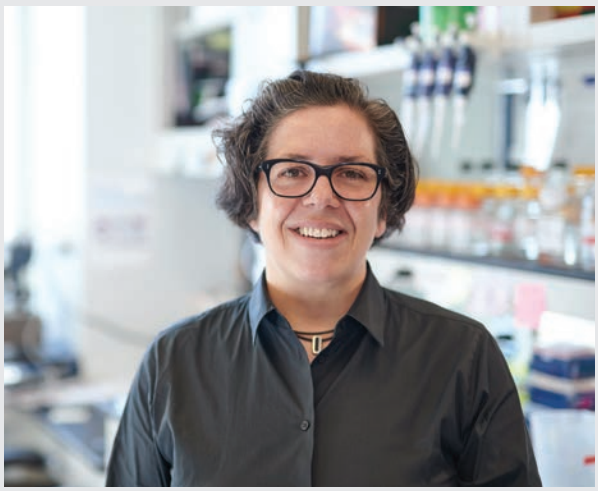
Lora Hedrick Ellenson
Surgical Pathologist
Appointed as Member, Memorial Hospital; Department of Pathology, Surgical Pathology Service; Director, Gynecologic Pathology

Ginger Gardner
Surgeon
Promoted to Member, Memorial Hospital; Department of Surgery, Gynecology Service; Vice Chair of Hospital Operations, Department of Surgery

Jason Konner
Medical Oncologist
Promoted to Clinical Member; Department of Medicine, Division of Solid Tumor Oncology, Gynecologic Medical Oncology Service

ENDOWED CHAIRS

Jaap-Jan Boelens was appointed to the Richard J. O'Reilly Chair in Honor of Kevin Zoltan Merszei.



Anna-Katerina Hadjantonakis was appointed to the Alfred P. Sloan Chair.

Anyi Li
Medical Physicist
Appointed as Associate Clinical Member; Department of Medical Physics; Chief, Computer Service

Joseph O'Donoghue
Medical Physicist
Promoted to Member, Memorial Hospital; Department of Medical Physics, Molecular and X-Ray Imaging Physics Service

Dongxu Wang
Medical Physicist
Appointed as Associate Clinical Member; Department of Medical Physics, Radiotherapy Physics Service

Joao Xavier
Systems Biologist
Promoted to Member; Computational and Systems Biology Program, Sloan Kettering Institute

ROXANNE TAYLOR APPOINTED AS CHIEF MARKETING & COMMUNICATIONS OFFICER

On February 3, Roxanne Taylor joined Memorial Sloan Kettering as Chief Marketing & Communications Officer. She will be responsible for shaping, enhancing, and building the long-term equity of the MSK brand.

An accomplished and recognized marketing professional, Ms. Taylor has more than three decades of experience helping the world's biggest companies tell their stories on a global stage. Ms. Taylor formerly served as chief marketing and communications officer at Accenture for more than ten years. ●

Atefeh Riazi was appointed Chief Information Officer (CIO) on February 3. As CIO, she will develop and implement an enterprise-wide, long-term strategic information technology plan and oversee the integration of data and technology resources across the organization.

Ms. Riazi joins MSK from the United Nations, where she managed and revitalized all information and communication technologies across the organization as chief information technology officer and assistant secretary general since 2013. Prior to that, she served in various CIO and executive roles, including at the New York City Housing Authority, Ogilvy & Mather, and the New York City Transit Authority. ●

MSK KUDOS

Cynthia McCollum was appointed to the executive committee of the National Comprehensive Cancer Network's board of directors.

D. David Dershaw, emeritus attending radiologist, received a Gold Medal from the Radiological Society of North America during its annual meeting.

Nancy Houlihan was elected to serve as president of the Oncology Nursing Society.

Alexander Rudensky received the 2020 American Association of Immunologists–Thermo Fisher Meritorious Career Award.

Michel Sadelain received the 2019 International Prize from Inserm (the French National Institute of Health and Medical Research).

MSKNews

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Rising to the Occasion

In the midst of the uncertainty that COVID-19 has brought to the world, one constant remains: the safe and exceptional care of our patients. Our staff is working around the clock to meet the needs of everyone who comes through our doors, and we're using our social media channels to give them a virtual high five. Meet some of the **#MSKHealthcareHeroes** who are making a difference both on the front lines and behind the scenes.

#MSKHealthcareHeroes

Memorial Sloan Kettering Cancer Center